UPPER ARKANSAS BASIN TOTAL MAXIMUM DAILY LOAD

Waterbody: **Arkansas River from the Colorado Stateline to Pierceville**
Water Quality Impairment: Selenium

1. INTRODUCTION AND PROBLEM IDENTIFICATION

Subbasin: Middle Arkansas-Lake McKinney **Counties:** Hamilton, Kearney and Finney

Ecoregions: Kansas Drainage in Western High Plains – Rolling Sand Plains (25b) & Moderate Relief Rangeland (25c)
Colorado Drainage in Southwestern Tablelands – Piedmont Plains and Tablelands (26e) & Sand Sheet (26k)

HUC 8: 11030001 **HUC 11s:** 010, 020, 030, & 080
11030003 010

Drainage Area: 1661 miles^2 between Garden City and Coolidge

Main Stem Segments: 1, 3, 5, 7 & 9 from Stateline to Pierceville near Finney-Gray county line **(Figure 1)**

Designated Uses: All uses with Special Aquatic Life Support & Primary Contact Recreation

303(d) Listing: Stream Segments monitored by Stations 223, 598 & 286 cited as impaired in 2002, 2004 & 2006 303(d) Lists

Impaired Uses: Special Aquatic Life Support, Groundwater Recharge

Water Quality Criteria: 5 µg/liter for Chronic Aquatic Life (KAR 28-16-28e(c)(2)(D)(ii))

In stream segments where background concentrations of naturally occurring substances, including chlorides and sulfates, exceed the water quality criteria listed in table 1a of the "Kansas surface water quality standards: tables of numeric criteria," as adopted by reference in subsection (d) of this regulation, at ambient flow, the existing water quality shall be maintained, and the newly established numeric criteria shall be the background concentration, as defined in K.A.R. 28-16-28b(e). Background concentrations shall be established using the methods outlined in the "Kansas implementation procedures: surface water quality standards," as defined in K.A.R. 28-16-28b(gg), and available upon request from the department. (KAR 28-16-28e(b)(9)).

In surface waters designated for the groundwater recharge use, water quality shall be such that, at a minimum, degradation of ground water quality does not occur. Degradation shall include any statistically significant increase in the concentration of any chemical or radiological contaminant or infectious microorganism in ground water resulting from surface water infiltration or injection.
(K.A.R. 28-16-28e(c) (5)).

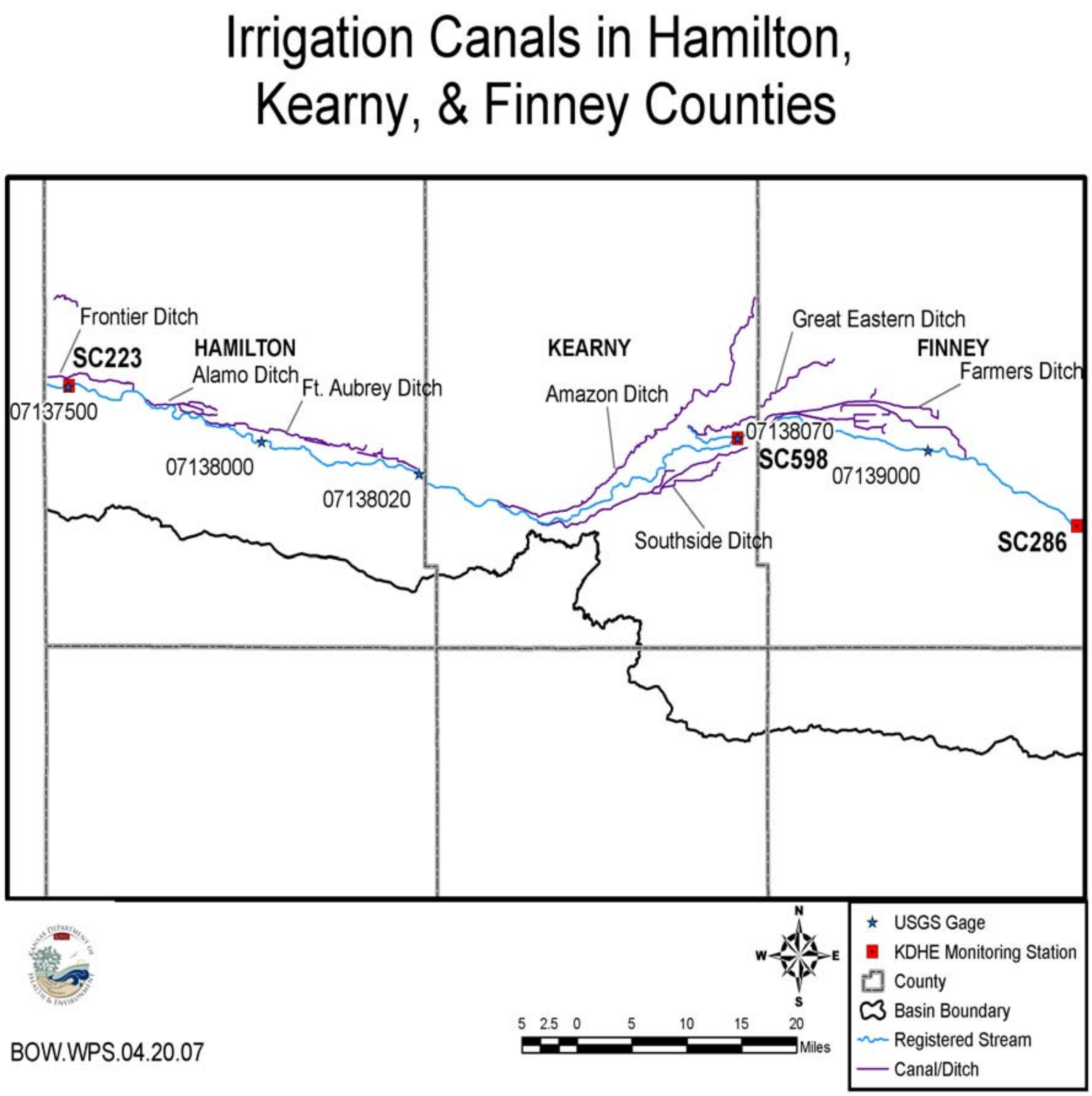

Figure 1. The Upper Arkansas River with Irrigation Ditches & KDHE Monitoring Stations

2. CURRENT WATER QUALITY CONDITION AND DESIRED ENDPOINT

Period of Record: Arkansas River Water Quality: Stations 223 (Coolidge), 598 (Deerfield) and 286 (Pierceville): 1996-2006. **Streamflow:** at Coolidge, Syracuse and Garden City: 1996-2006; at Deerfield: 1998-2006; at Kendall: 2000-2006. **Continuous Conductivity** at Coolidge: 1999-2006. **Biology:** 2005-2006.

Hydrology: The Arkansas River suffers from extended periods of depletion throughout the valley below John Martin Reservoir in Colorado. Lack of water coming from Colorado and extensive ground water appropriation along the river in Kansas has reverted the river to a losing condition between Coolidge and Garden City. Figure 2 displays daily flows at the five stations between the Stateline and Garden City. Fairly good flow was seen throughout the river between 1996 and 2001. Flows began to decline in 2001 and continued downward until no flow has been seen at Garden City since mid-2002. Deerfield, upstream at the Kearny-Finney county line began encountering dry periods after 2003. Flow duration curves for Coolidge show that the curve for 1990-2006 is bracketed by the generally wet conditions of 1996-2001 and pervasive dry conditions of 2002-2006 (Figure 3). Similar relations hold at Garden City, though the flows are much more depleted at that station than upstream (Figure 4). Most of the flow seen at Garden City since 2002 occurred in the first six months of 2002; the river has been mostly dry since then. Deerfield flows reflect Coolidge conditions during the wet period, but simulate Garden City during the current dry period (Figure 5).

Table 1 displays the seasonal averages in flow along the river from John Martin Reservoir in Colorado to Garden City since 1996. The wet period prior to 2002 is marked by substantially higher flows in both the irrigation (April to October) season and the off-season (November to March). After 2001, flows released from John Martin and gained along the river dropped substantially. Much of the flow during irrigation season is contributed by releases from John Martin. Once releases cease in November, flow in the river is composed mostly of ground water returning to the channel after it had mounded under the flood-irrigated lands in the summer. Once in Kansas, Arkansas River flows decrease either because of diversion by irrigation ditches (Figure 1) or loss to the surrounding alluvium along the river above Garden City.

	Irrigation Season: April to October							
Ark River Location	**Below John Martin Dam**	**Lamar**	**Granada**	**Coolidge**	**Syracuse**	**Kendall (2000-2006)**	**Deerfield (1998-2006)**	**Garden City**
1996-2001	754 cfs	370 cfs	452 cfs	596 cfs	527 cfs	333 cfs	406 cfs	277 cfs
2002-2006	337 cfs	86 cfs	81 cfs	102 cfs	84 cfs	76 cfs	8.3 cfs	0.0 cfs
	Off-Season: November to March							
Ark River Location	**Below John Martin Dam**	**Lamar**	**Granada**	**Coolidge**	**Syracuse**	**Kendall (2000-2006)**	**Deerfield (1998-2006)**	**Garden City**
1996-2001	131 cfs	106 cfs	204 cfs	290 cfs	297 cfs	175 cfs	215 cfs	247 cfs
2002-2006	25 cfs	15 cfs	39 cfs	66 cfs	62 cfs	62 cfs	15 cfs	6.4 cfs

Table 1. Seasonal Average Flows Along Arkansas River between John Martin Dam & Garden City
(Source of Data: US Geological Survey Daily Flow Data for Gaging Stations in Kansas and Colorado)

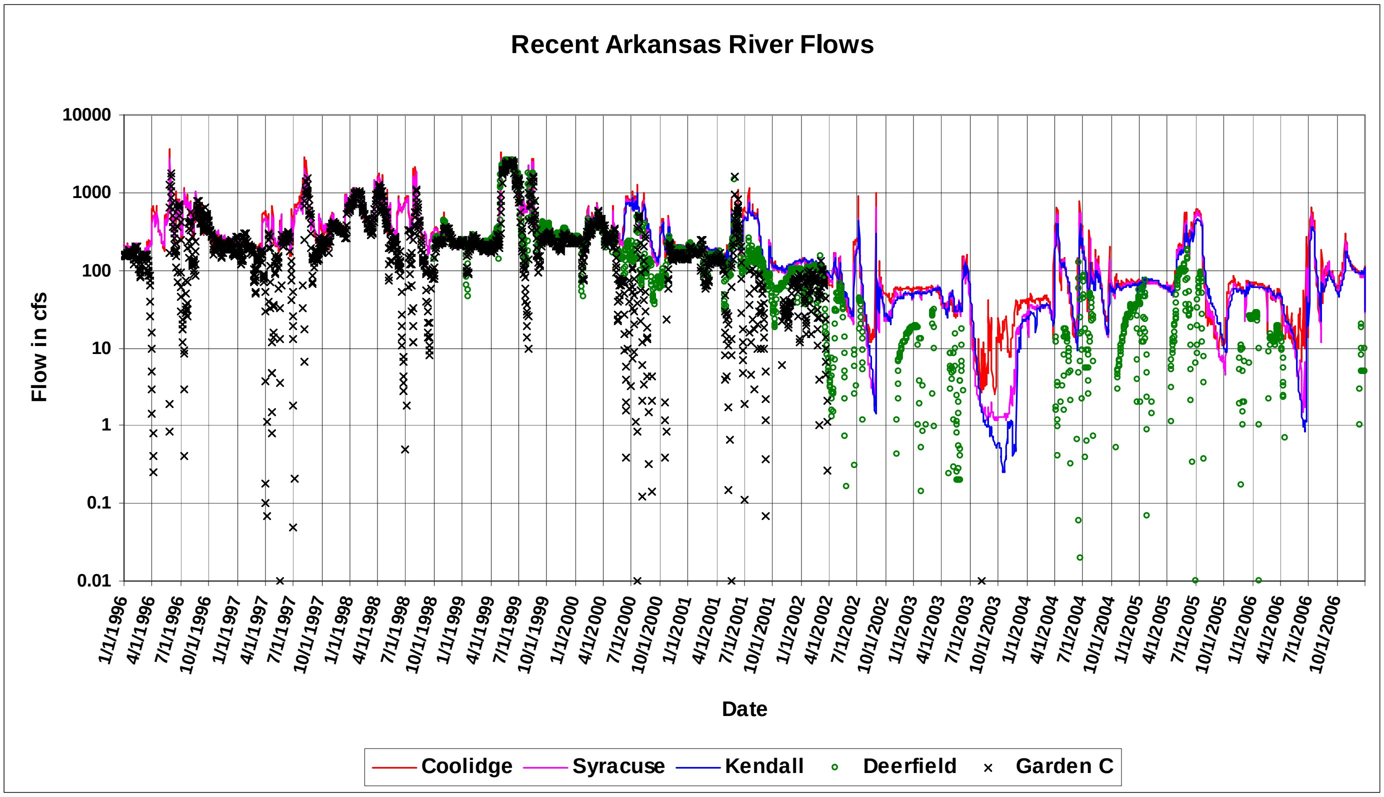

Figure 2. Daily Flows on Arkansas River from Stateline to Garden City

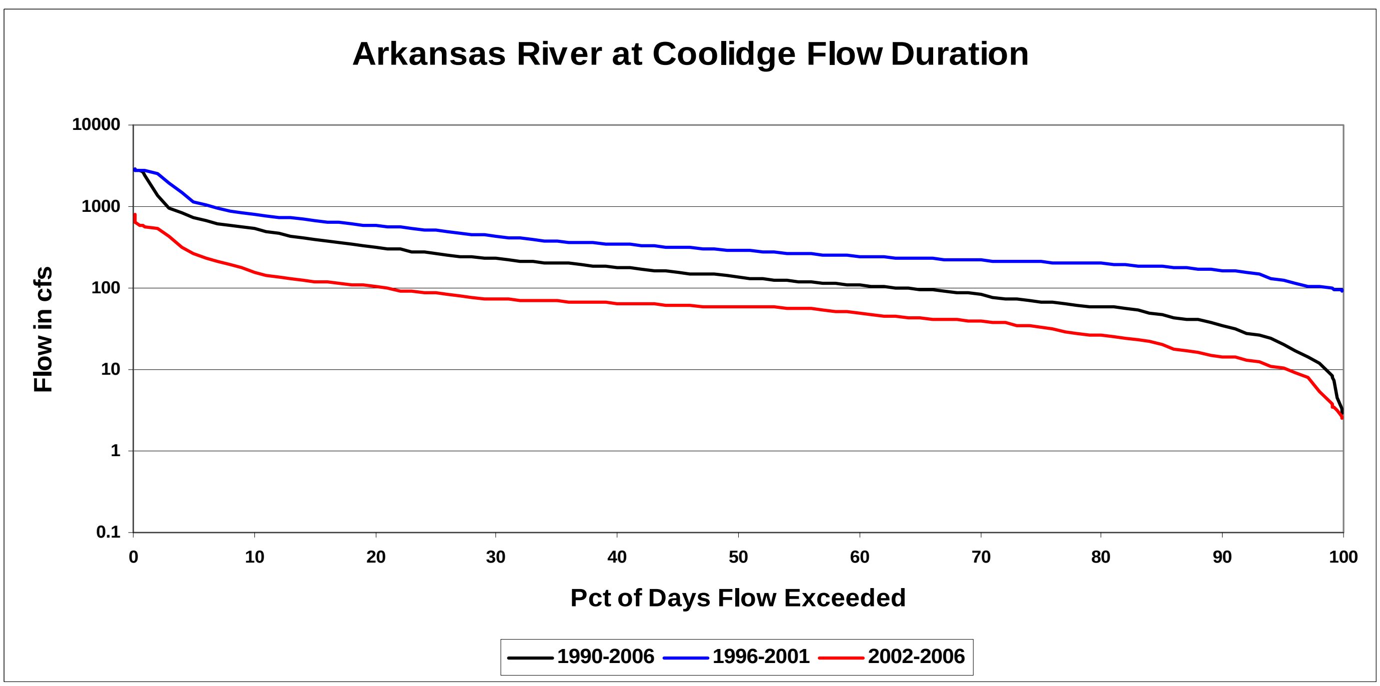

Figure 3. Flow Duration of Arkansas River at Stateline at Coolidge

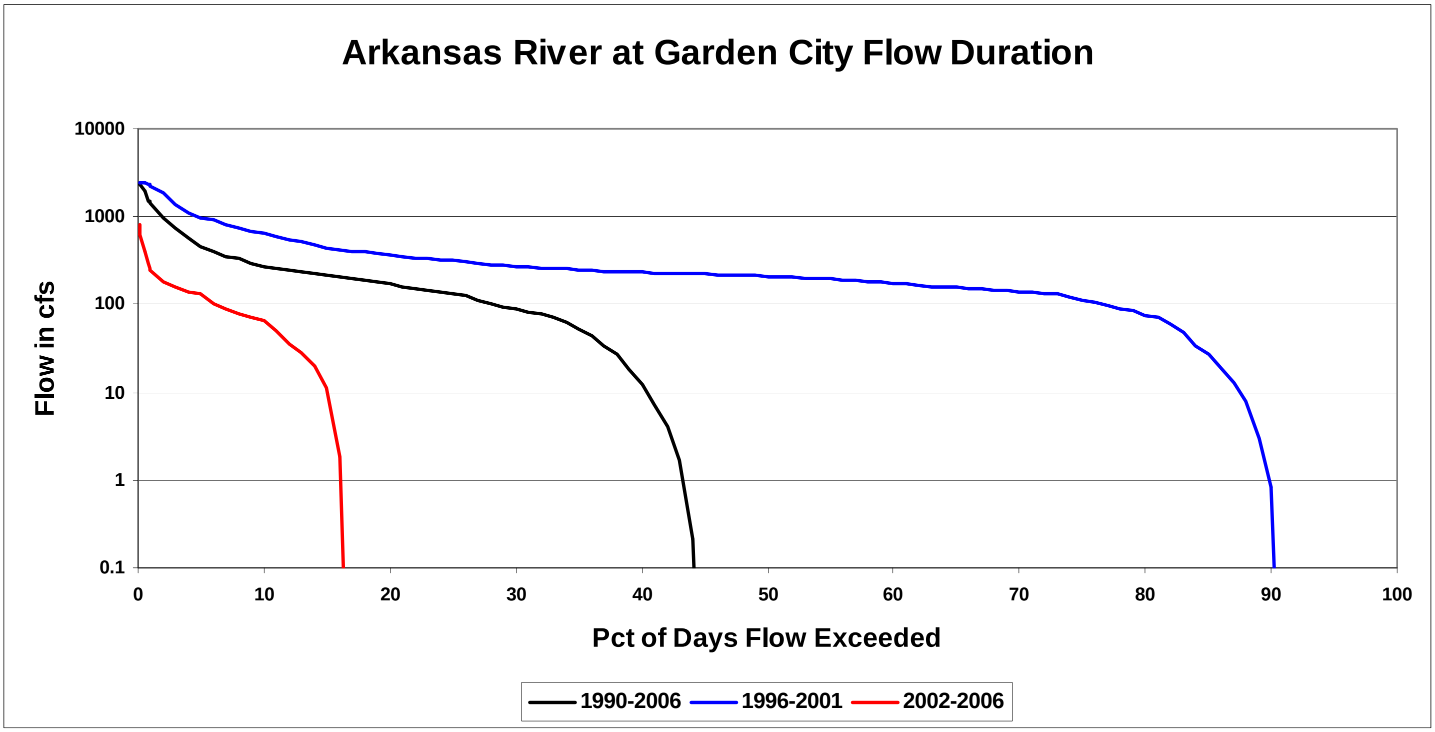

Figure 4. Flow Duration of Arkansas River at Garden City

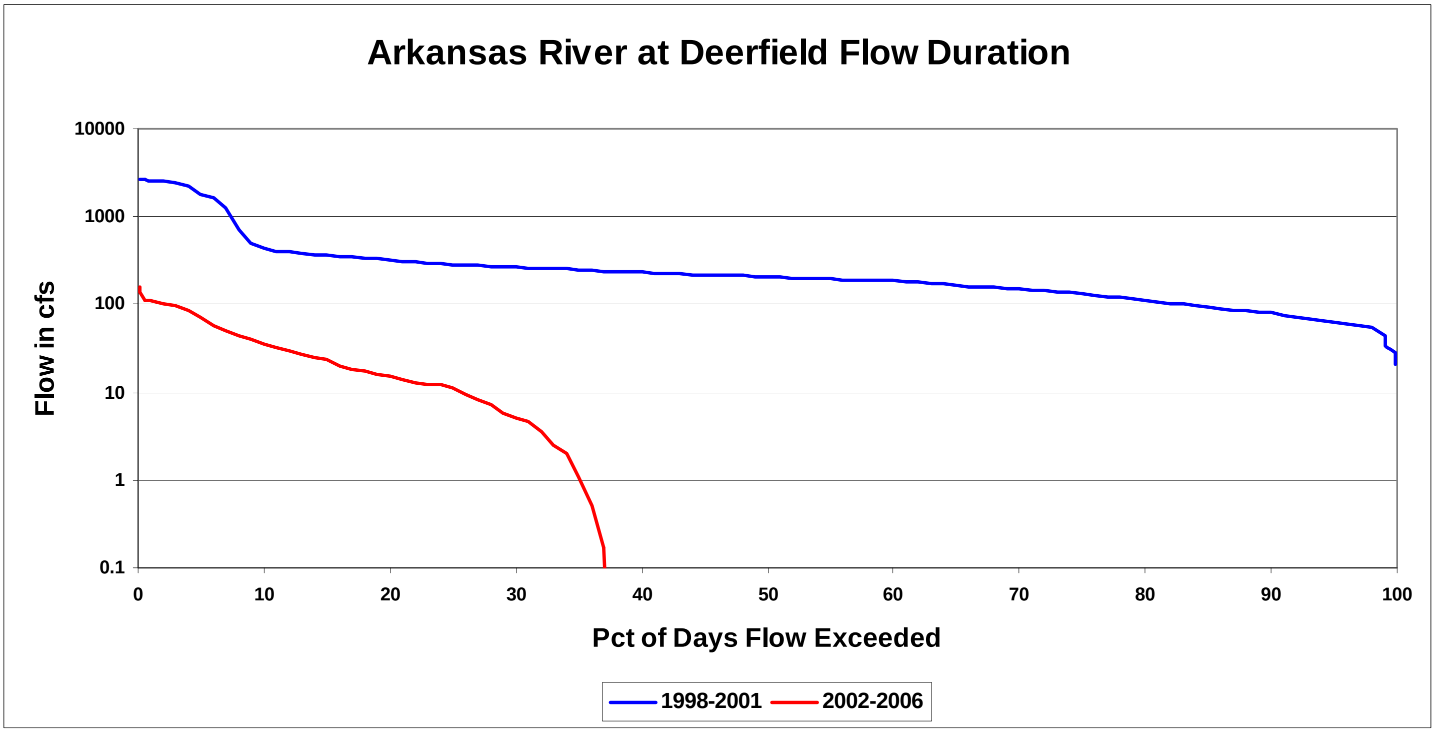

Figure 5. Flow Duration of Arkansas River at Deerfield

Whittemore (2000) displayed maps of ground water along the Arkansas River valley (Figure 6). High sulfate is seen in the alluvium and to some degree in the High Plains aquifer, resulting from induced infiltration of highly saline Arkansas River into the surrounding ground water. Coe

(1998) indicated similar elevated TDS patterns in the ground water between Lakin and Garden City in 1996-1997. Selenium is expected to follow the same hydraulic pathways from river to ground water. The greatest concentrations are seen in the immediate vicinity of the river and where large irrigation diversion of ground water begin east of the Bear Creek Fault in mid-Kearny County. The diminishment of streamflow east of Garden City confines the intrusion of saline water to the immediate alluvium of the river.

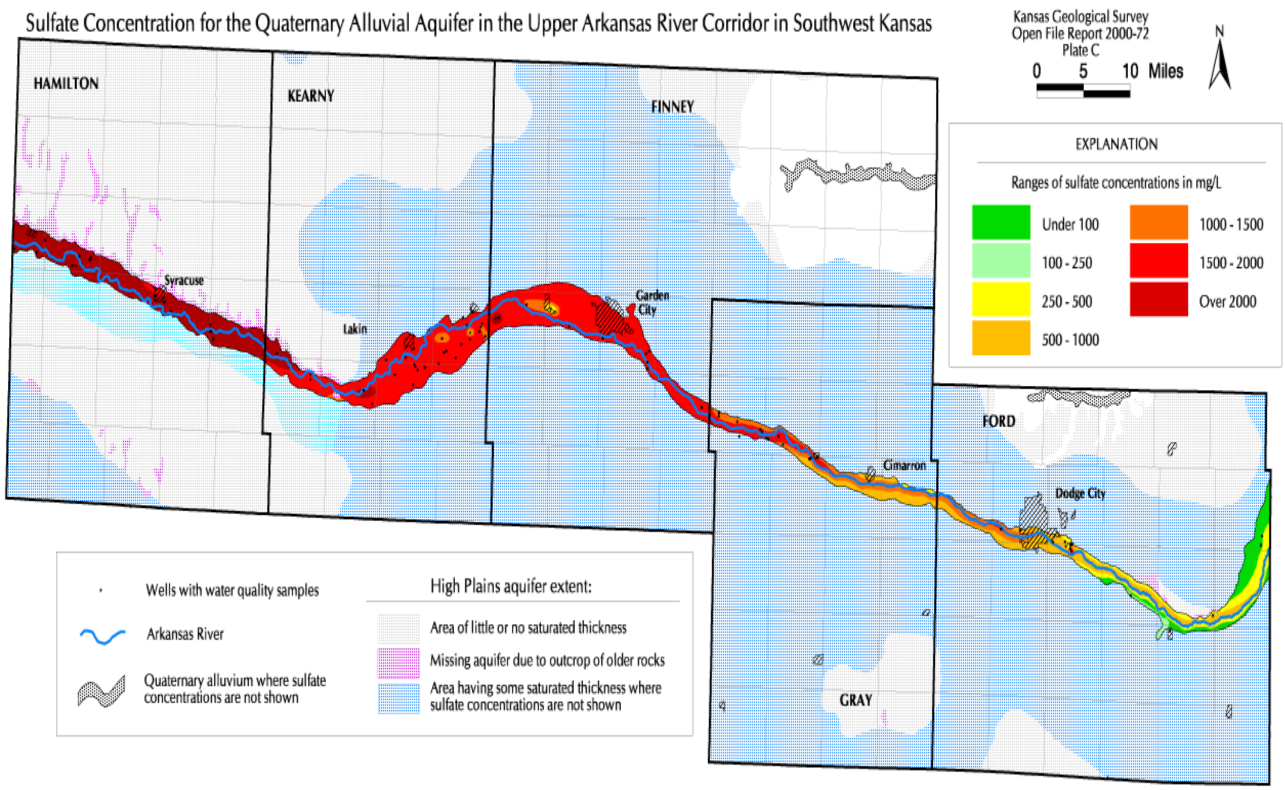

Figure 6. Sulfate Concentrations in Alluvial Aquifer of Upper Arkansas River (Whittemore, 2000)
[Light Blue Shading in Hamilton & Kearny Counties Indicates Paleovalley Sand Dune Deposits Distinct from Alluvial or High Plains Aquifer Deposits]

Conductivity Response

The conductivity of the river follows this hydrologic and seasonal pattern (Figure 7). Initial conductivity measured on the river at the Stateline was relatively low from 1999-2000. As conditions began to dry in 2001, conductivity levels, indicative of increased total dissolved solids, such as sodium and selenium, rose. Conductivity remains high since 2002, although episodic decreases are seen, typically associated with a runoff event or a pulsed release from John Martin arriving at the Stateline. Seasonality is seen with elevated conductivity during the winter months and sharp decreases in early summer, followed by gradual increases as the irrigation season progresses. Average conductivity was 3018 uS/cm for April – October of 1999-2001, rising to 3768 uS/cm for the same months in 2002-2006. Wintertime average conductivity was 3652 uS/cm from 1999-2001, but jumps to 4337 uS/cm during 2002-2006.

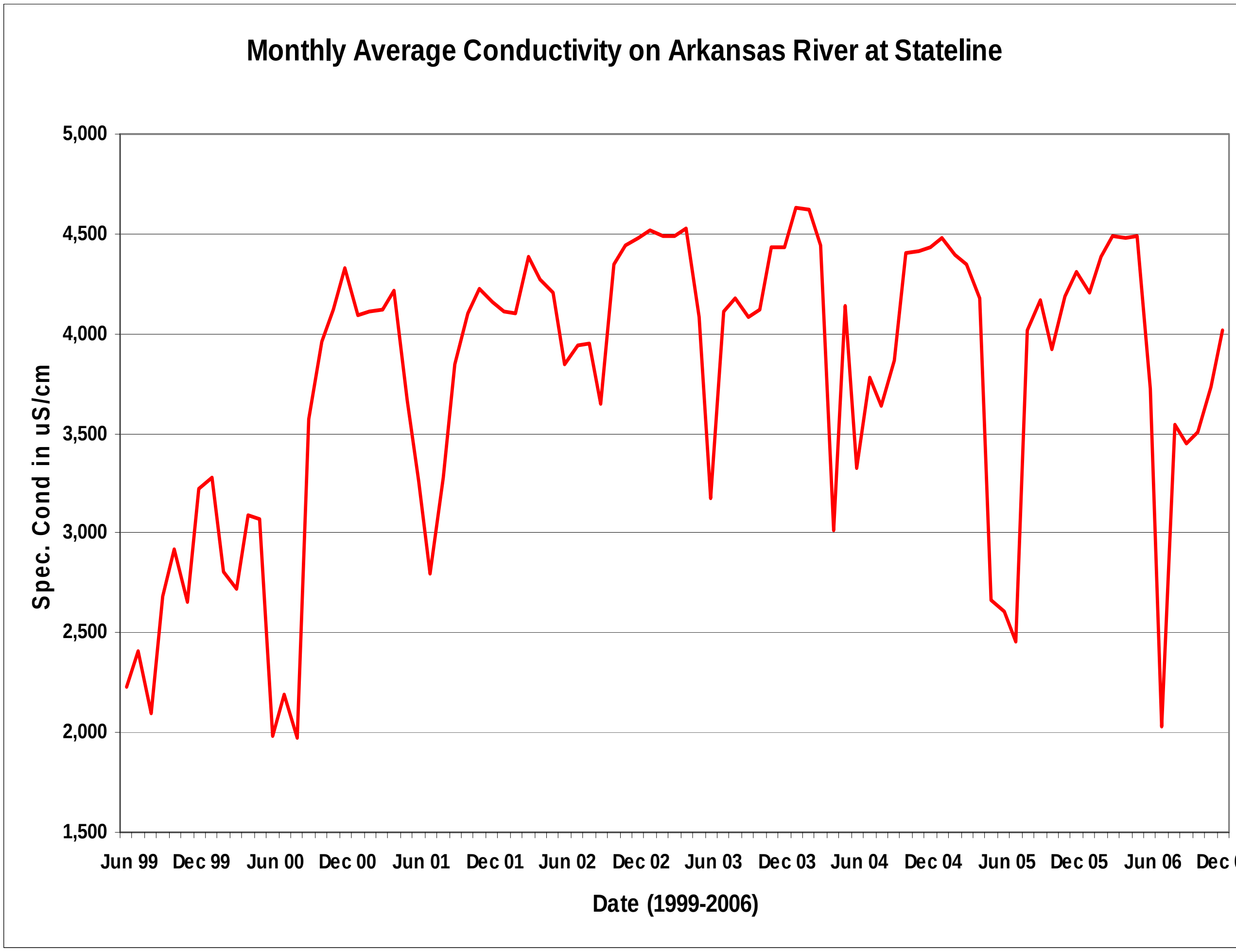

Figure 7. Monthly Average Conductivity on Arkansas River at Stateline (1999-2006)

Selenium Concentrations in River

Selenium levels jump in the river between 2001 and 2002 (Figure 8). Winter concentrations tend to be higher than those seen during the irrigation season. Concentrations begin to dilute in the downstream direction from the Stateline, regardless of season. Pierceville was only sampled once in early 2002; the station has been dry since that time. Samplings after 2002 at Deerfield also were sporadic as dry channels were encountered more frequently during visits since 2003. The increase in selenium in the period beginning with 2002 coincided with the drying conditions incurred on the river with deficient snowpacks in the Colorado Rockies diminishing streamflows flowing into John Martin Reservoir. Releases from John Martin were largely diverted to Colorado lands and then eventually returned to the channel in order to meet Arkansas River Compact obligations to Kansas. During the winter off-season, releases were minimal in order to conserve storage for the following year. Because of the lack of high inflows replenishing storage, spills of relatively fresh water from Pueblo and John Martin Reservoirs, such as seen during 1996-2001, were eliminated. Thus, ground water discharges and irrigation return flows from the lower river valley comprised the majority of the streamflow at the Stateline since 2002. This water was elevated with sulfate and selenium as salts were leached from the soil profiles of the irrigated lands. Furthermore, the consumptive use of water by crops and other vegetation in the valley reduced the water supply of the valley, thereby concentrating these salts in a smaller volume of water reaching Kansas. Since 2002, the flow at Coolidge has been markedly lower than that seen over 1996-2001 as well as more saline, including higher in selenium (Figure 9).

Selenium levels increase substantially between John Martin Reservoir and the Stateline. Colorado analyzes dissolved selenium as opposed to the total recoverable selenium analyzed by Kansas. Nonetheless, Table 2 indicates the increase in selenium moving down the river from the dam at John Martin. Fairly moderate selenium concentrations are seen coming out of John Martin Reservoir. A large proportion of water is diverted between the dam and Lamar, although some return flows enter the river and elevate its selenium content. However, substantial increases in selenium are seen between Lamar and the Stateline as diversions and return flows swap relatively fresh water with post-irrigation saline water. During 1996-2001, the Arkansas River valley was hydrologically charged from the ample snowmelt from the mountains. Irrigation demands were muted slightly because of the favorable soil moisture and a higher proportion of fresh water made it to the Stateline.

Colorado Water Quality Standards have a policy for establishing temporary modifications to the Table Value Standards for certain constituents. These temporary modifications indicate the TVS cannot be achieved and there is uncertainty as to what the actual criterion should be. In the meantime, the temporary modification is calculated as the 85th percentile of the ambient data over the past five years. Currently, the temporary modification for dissolved selenium is 14 ug/l, but proposals for updating that value will increase it to 22.5 ug/l, based on the data from 2001-2006. The calculation for the Arkansas River below John Martin considers the data from water released from the dam, at Lamar, Granada and Holly in total. This aggregation of data along with the selection of a statistic representing the extreme concentrations yields the high temporary modification value for what Colorado considers the Lower Arkansas River.

Arkansas R Station	**A-O 1996-2001**	**N-M 1996-2001**	**A-O 2002-2006**	**N-M 2002-2006**
Below John Martin	7.9 ppb	3.5 ppb	8.6 ppb	6.7 ppb
At Lamar	8.9 ppb	13.6 ppb	7.9 ppb	12.8 ppb
At Granada & Holly	12.5 ppb	13.0 ppb	25 ppb	30 ppb
Stateline at Coolidge	**6.8 ppb (Tot.Recvb)**	**9.8 ppb (Tot.Recvb)**	16.4 ppb (Tot.Recvb)	19.3 ppb (Tot.Recvb)

Table 2. Average selenium values seen on the Arkansas River between John Martin & the Stateline. (Bolded Values indicated alternative background concentrations for selenium in Kansas, pursuant to Kansas Surface Water Quality Standards.)

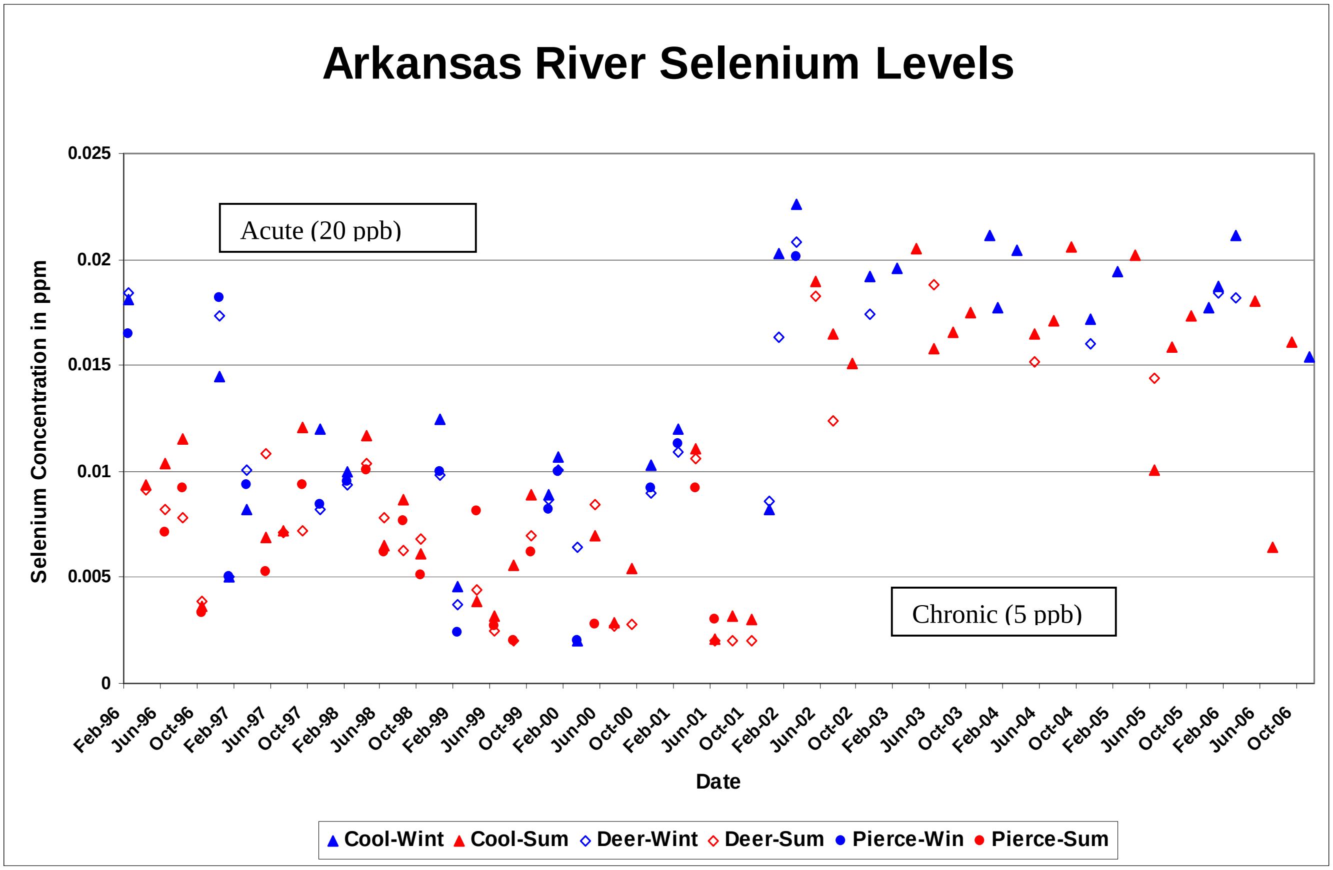

Figure 8. Selenium Concentrations in the Arkansas River at Coolidge, Deerfield and Pierceville.

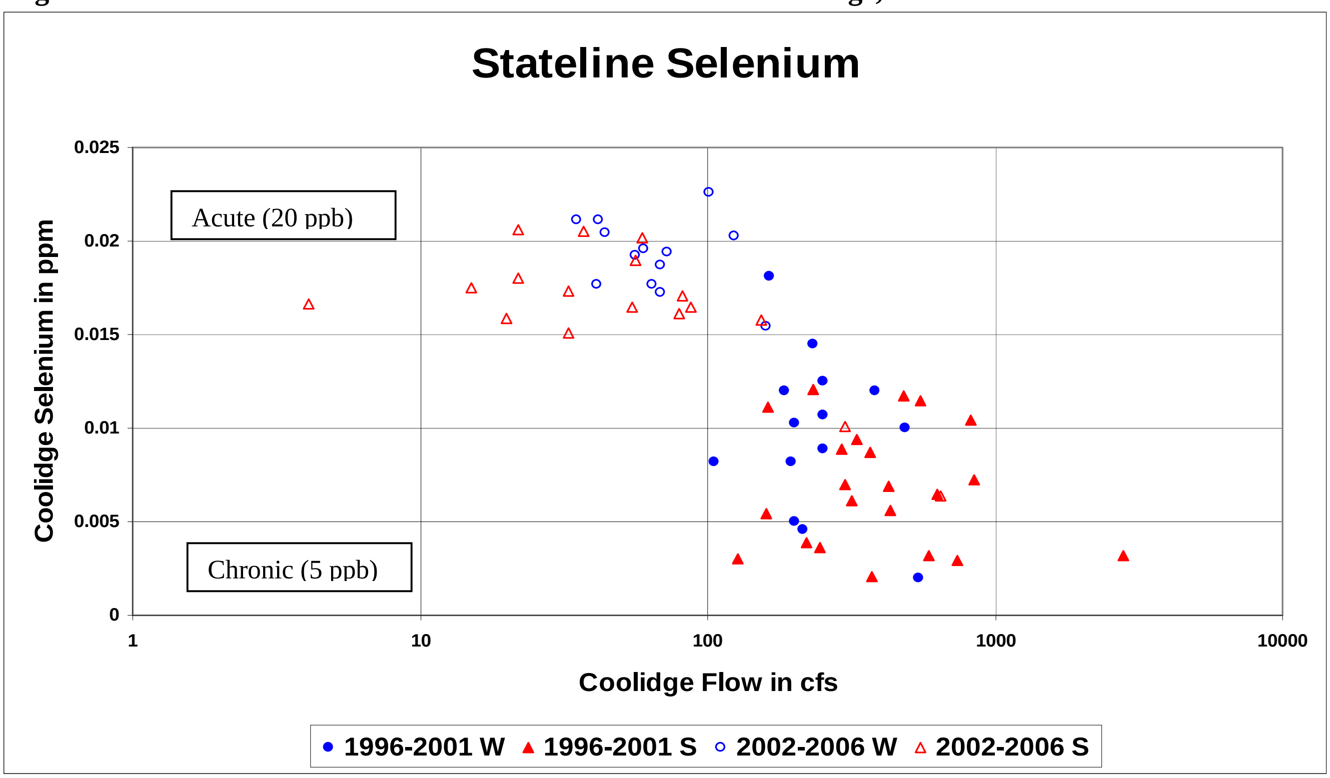

Figure 9. Seasonal Selenium concentrations at various flows seen at the Stateline at Coolidge.

While the selenium levels leaving John Martin since 2002 are not substantially different from earlier values, the impact of water use in the valley results in considerably higher concentrations arriving into Kansas. The average concentrations seen at the Stateline during 1996-2001 probably represent the best conditions to be achieved in the valley and are the least likely anthropogenic influenced values seen on the river. These values mirror the concentrations of selenium coming out of John Martin Reservoir.

Therefore, one outcome of this TMDL will be to suggest revising Kansas Surface Water Quality Standards to account for background levels of selenium seen at the Stateline and substitute the seasonal values of 7 ug/l from April to October and 10 ug/l from November to March in place of the current criterion of 5 ug/l of total recoverable selenium. The summer value represents a condition where streamflow reflects water released by John Martin Reservoir. The winter value recognizes that release cease from John Martin during the off-season and the flows seen at the Stateline are largely more saline ground water discharges into the river from the valley lands.

Once surface water entered Kansas, it is largely diverted through the irrigation ditches located in Hamilton and Kearny counties. Because of more areal extent of irrigation land laterally from the river in Kansas, return flows from these lands were minimal, although some wastage re-enters the river in order to hydraulically operate the ditch delivery systems. Furthermore, any water percolating through the soil profile in the ditch service lands is likely be induced to move downward in response to the gradient created by the lowered water tables created by regional ground water pumping.

Plotting concurrent samples from Coolidge, Deerfield and Pierceville shows a general condition of lowered concentrations as flows move downstream (Figure 10). There are some discrepancies, particularly at lower concentrations, but they may reflect differences in day-to-day selenium levels in the river. Selenium seen at Coolidge on one day will not be sampled that same day at the downstream stations, particularly at Pierceville. Because of the depleted conditions seen in the vicinity of Garden City, substantial flows have to deliver selenium to Pierceville. The travel time of those flows ensure that samples at Pierceville reflect conditions at the Stateline earlier in the week.

There tends to be greater dilution of winter flows and their selenium content as the river moves downstream toward Deerfield (Figure 11). This is probably a result of less flow arriving from Colorado in winter than in summer and a slower travel time of those flows. The samples from 2002-2006 reflect higher selenium concentrations, but a consistent dilution in the downstream direction. A similar pattern is present at Pierceville, although depletion of streamflows have eliminated any flow to sample since 2002, with the exception of the highest value seen at Pierceville (Figure 12).

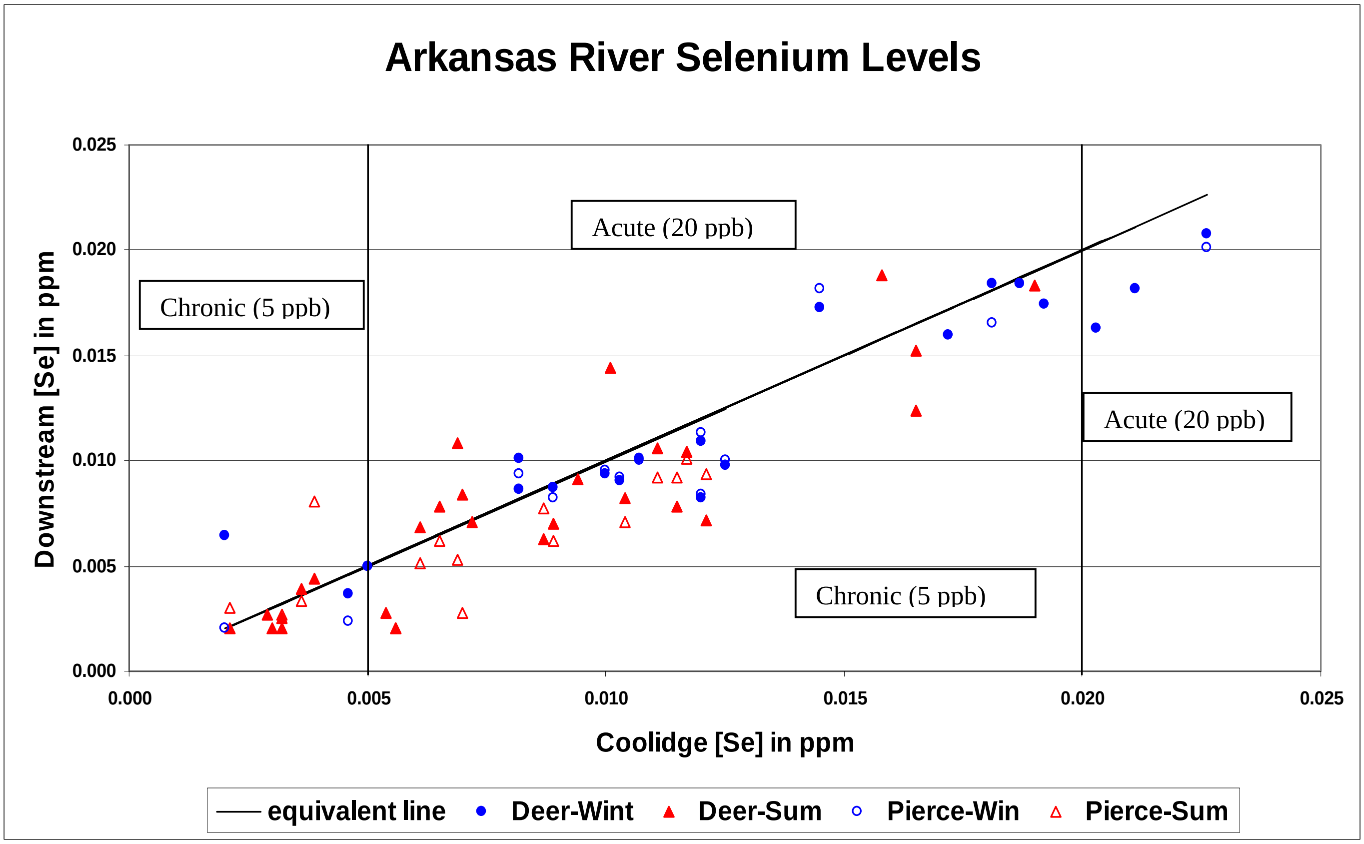

Figure 10. Concurrent Day Selenium Concentrations Along the Upper Arkansas in Kansas.

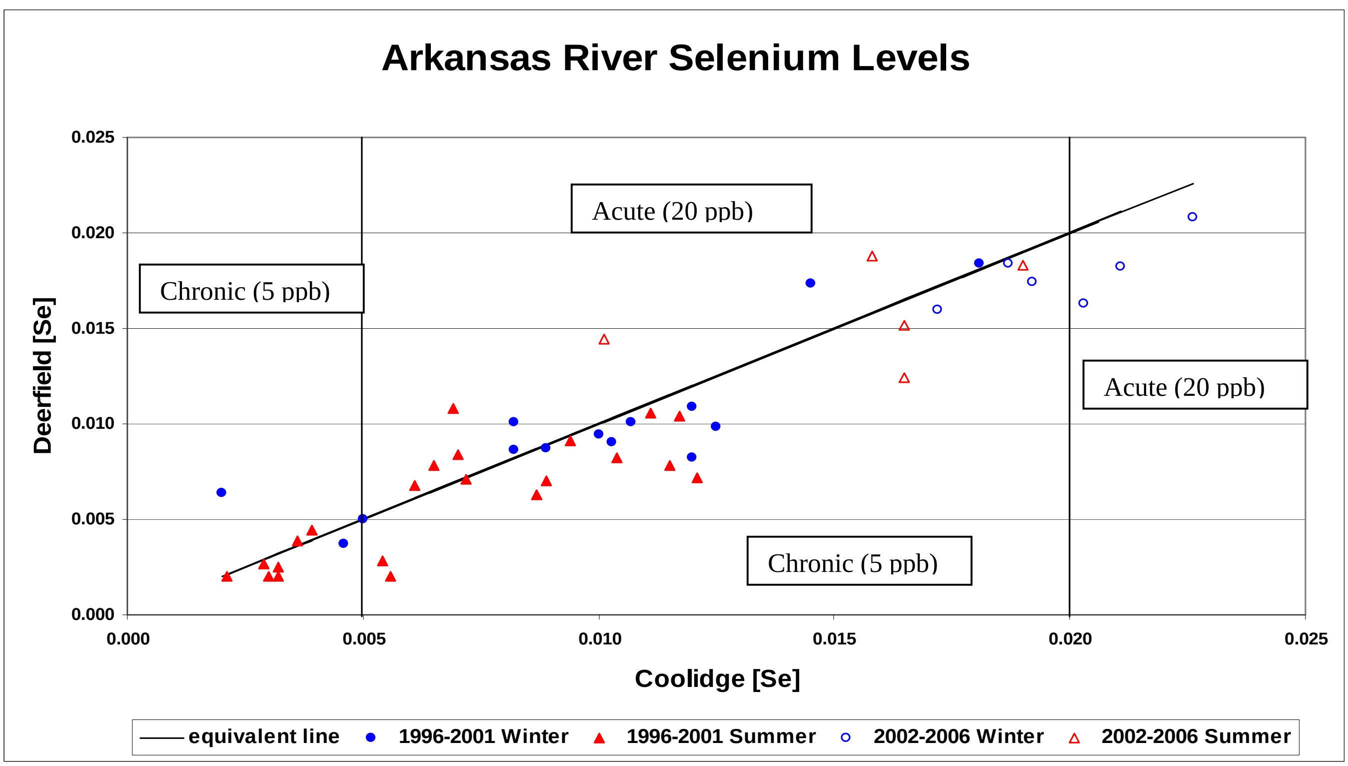

Figure 11. Concurrent Day Seasonal Sampling of Selenium (ppm) at Coolidge and Deerfield.

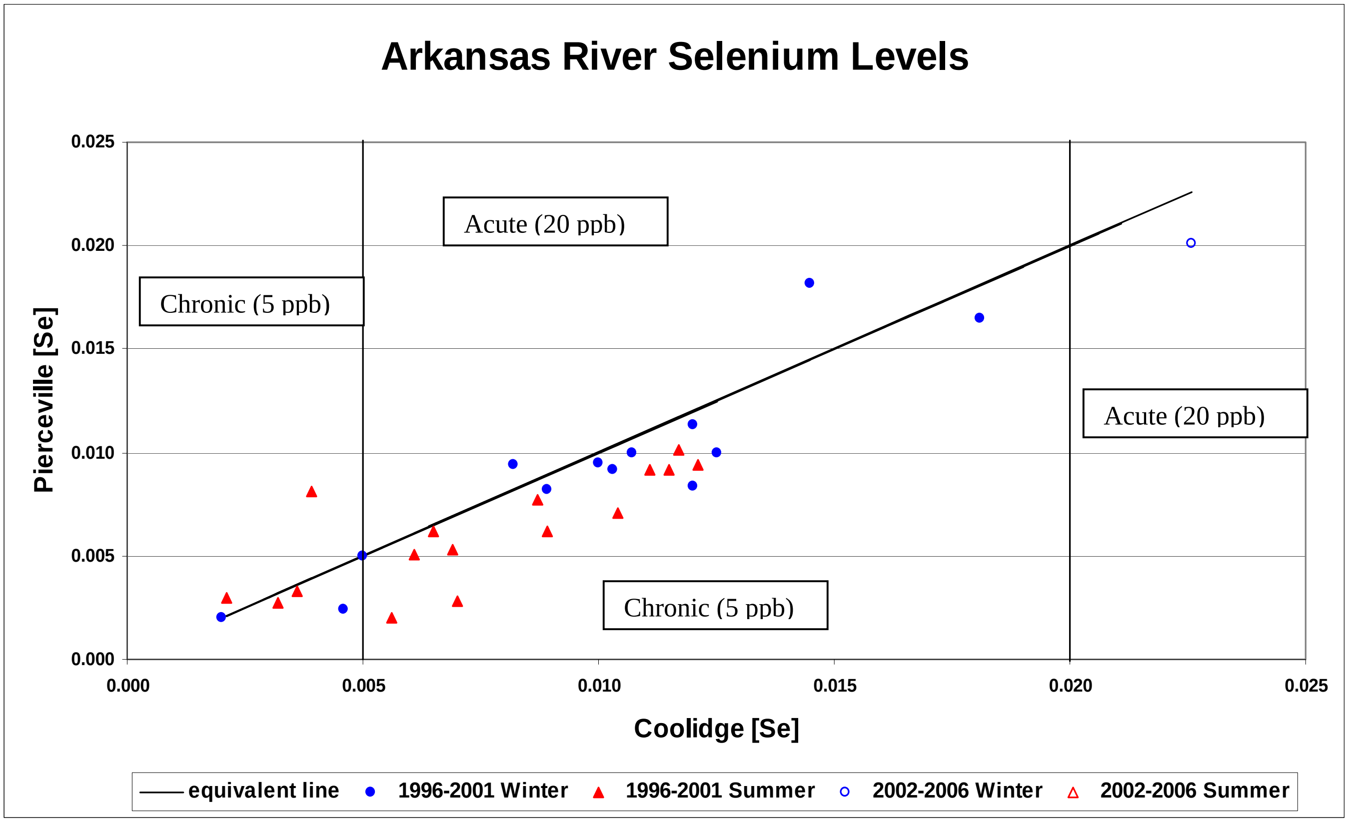

Figure 12. Concurrent Day Seasonal Sampling of Selenium (ppm) at Coolidge and Pierceville

Selenium Loading Patterns

At the Stateline, instantaneous loads at recent low flows lie astride the TMDL load duration curve representing the current acute criterion of 20 ug/l (Figure 13). Loading during the more favorable conditions of 1996-2001 lies within the two load duration curves (acute and chronic) at flows greater than median flow. If a cubic regression is applied to the instantaneous loads, the resulting curve represents the current condition of loading seen at the Stateline (Figure 14)

If regressions are developed for the wintertime and summertime loads, the resulting curves show a tendency to approach or exceed the desired acute loading at low flows, particularly during winter (Figure 15). The winter load curve is quite flat, indicating very little variation in flows once John Martin releases and valley irrigation ceases. The curve also implies a steady load delivered to the river. The current summertime loadings tend to be less than those of winter, signifying the input of some fresher water during irrigation season. Summer loads do exceed those of winter at very high flows, but are not much different than the desired chronic load.

Comparison of the generalized selenium load occurring in 1996-2001 and 2002-2006 shows a wide divergence in loading, with much greater loads occurring recently than during the favorable period of the late 1990's (Figure 16). Current loads lie along the acute load curve at low flows and meet the earlier period loads once conditions approach mean annual flow at the Stateline. Those earlier loads were quite low at flow conditions below median flow then slightly exceeded the desired chronic load at higher flows. If the period loads are plotted against the summer and winter loads suggested by this TMDL, the earlier period is compliant, by design, while the current loadings indicate the amount of reduction that needs to be done (Figures 17 & 18).

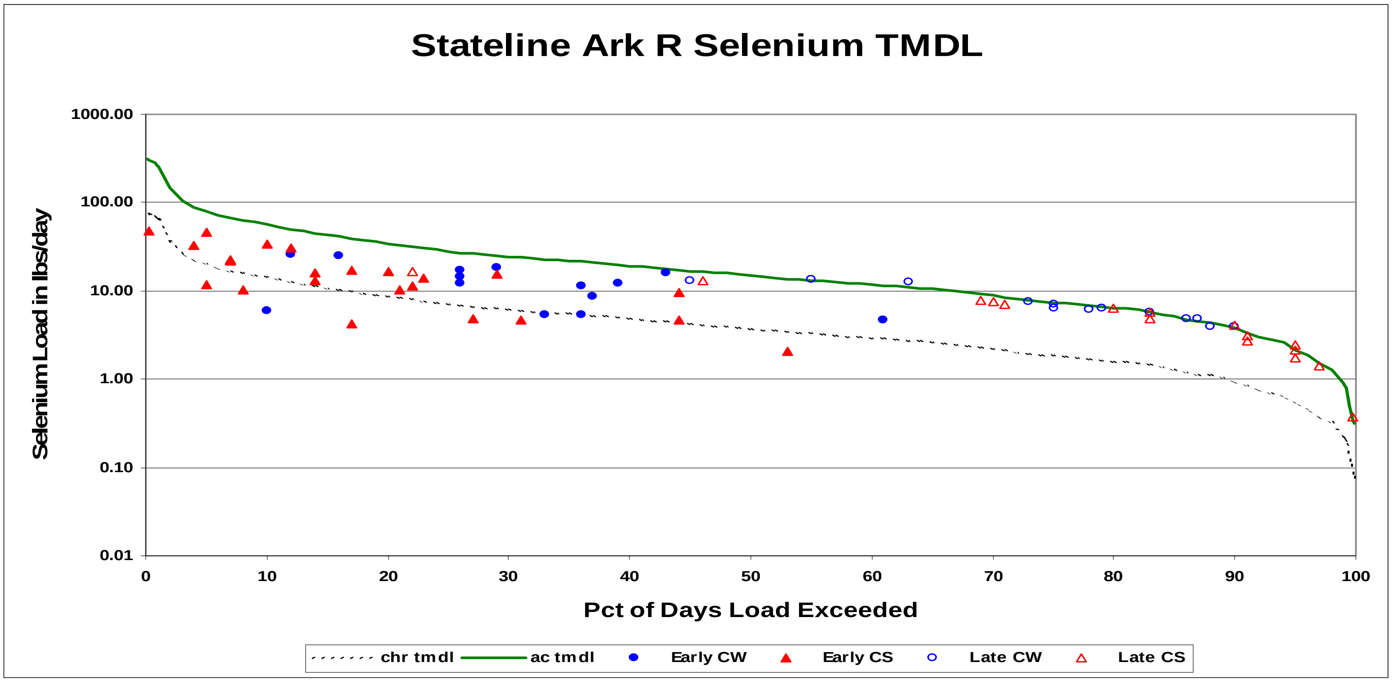

Figure 13. Ark River Selenium Loads at Coolidge Compared to Desired Chronic & Acute Loads

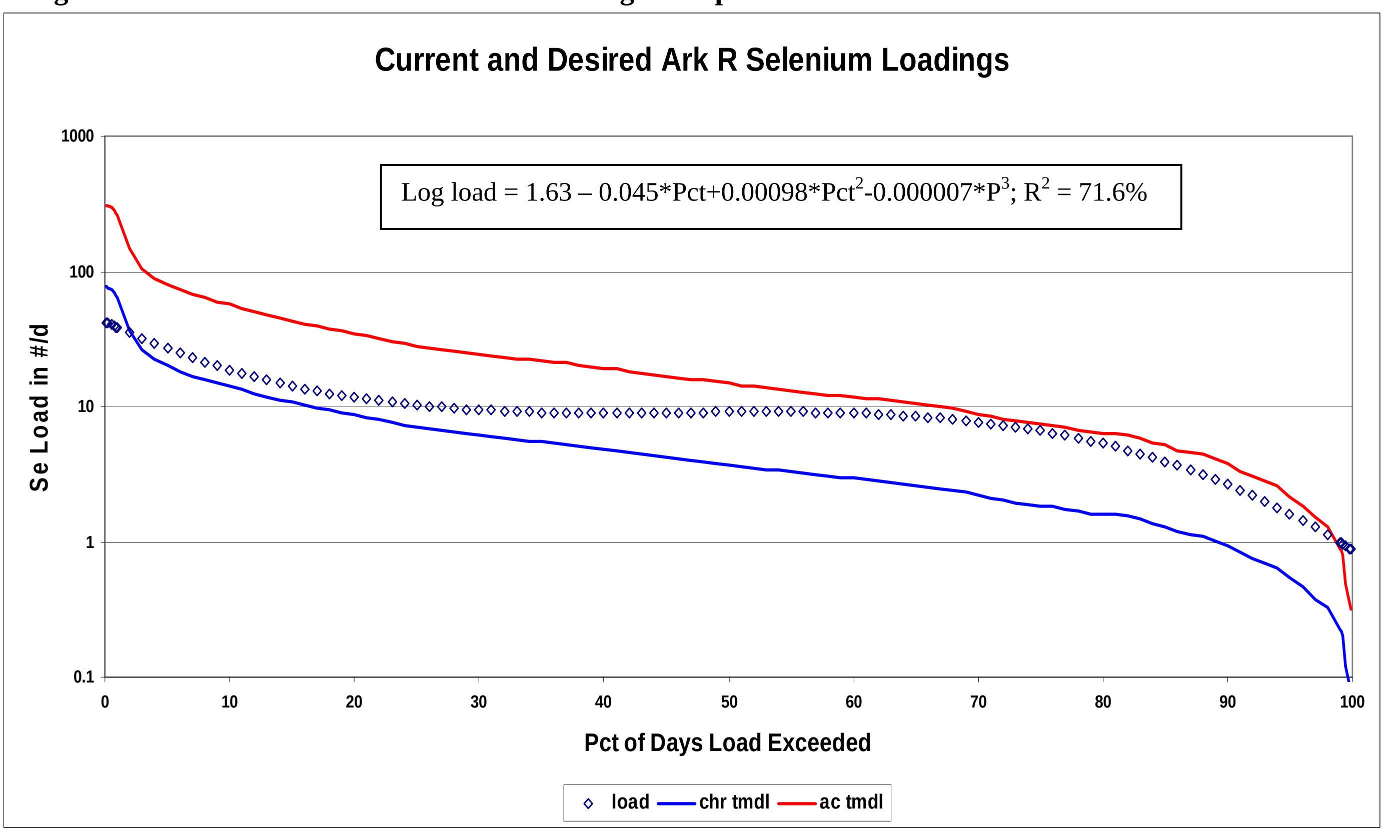

Figure 14. Generalized Current Selenium Load at Coolidge Compared to Chronic & Acute Load

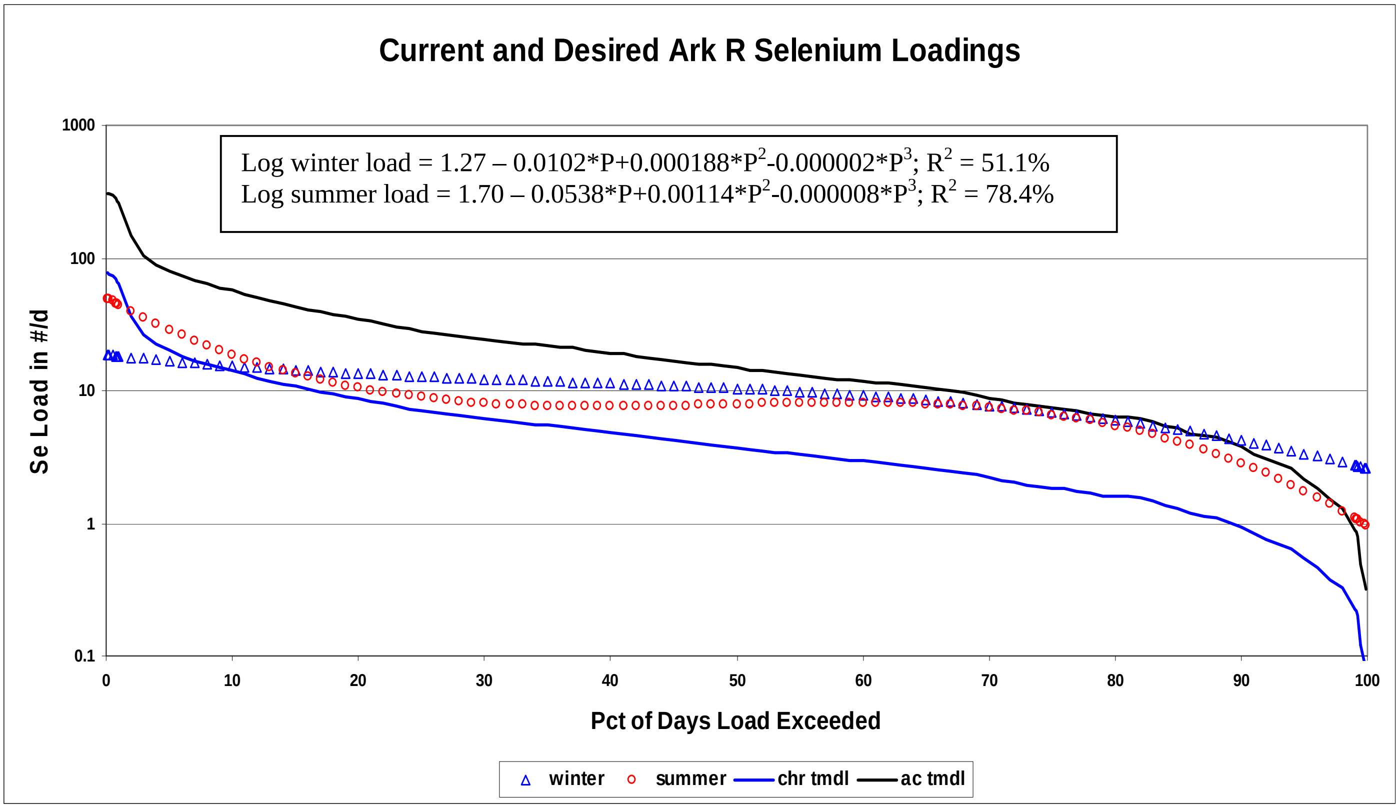

Figure 15. Winter & Summer Loads at Coolidge Compared to Desired Chronic & Acute Loads

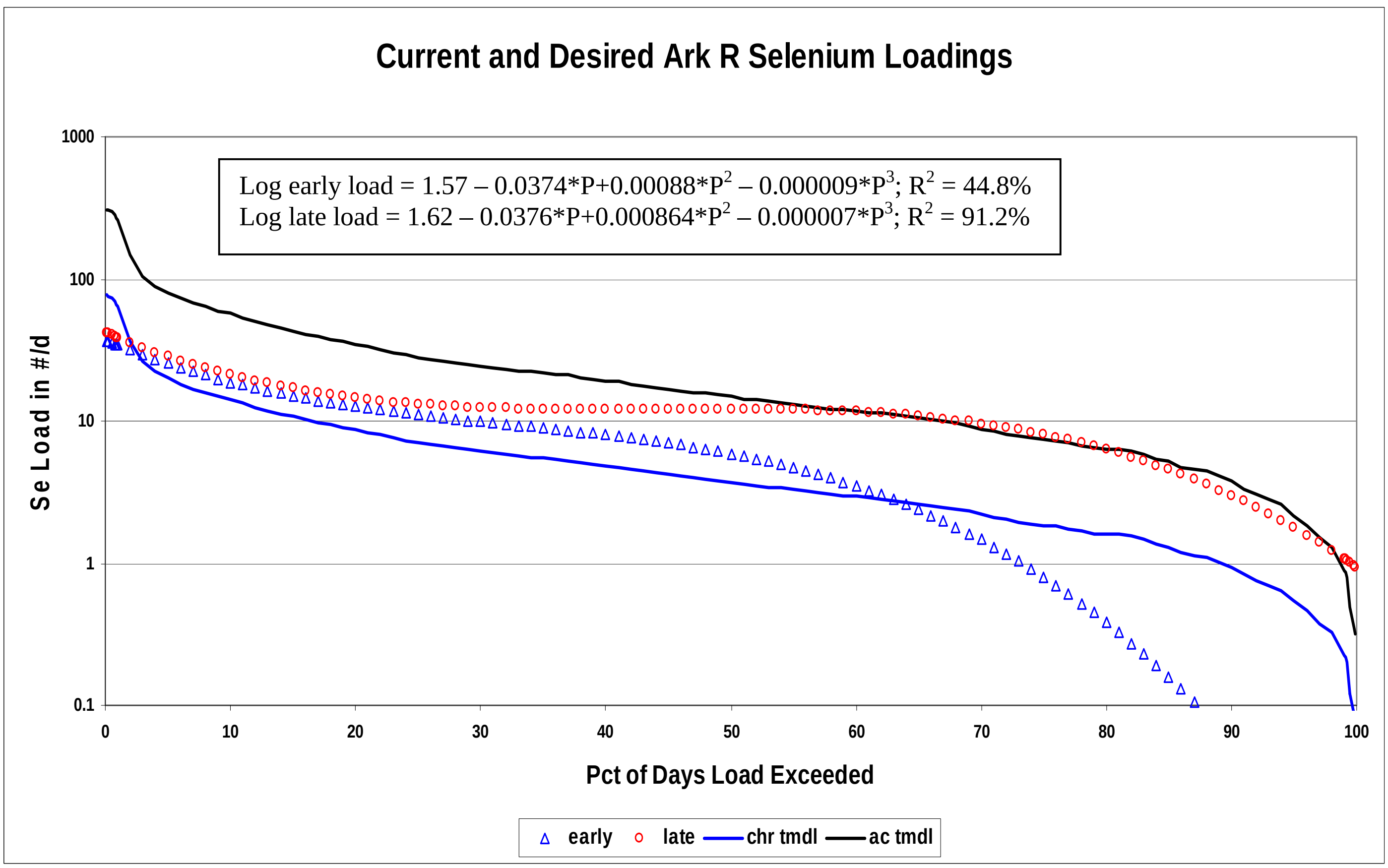

Figure 16. Early (1996-2001) & Late (2002-2006) Coolidge Loads Compared to Desired Chronic & Acute

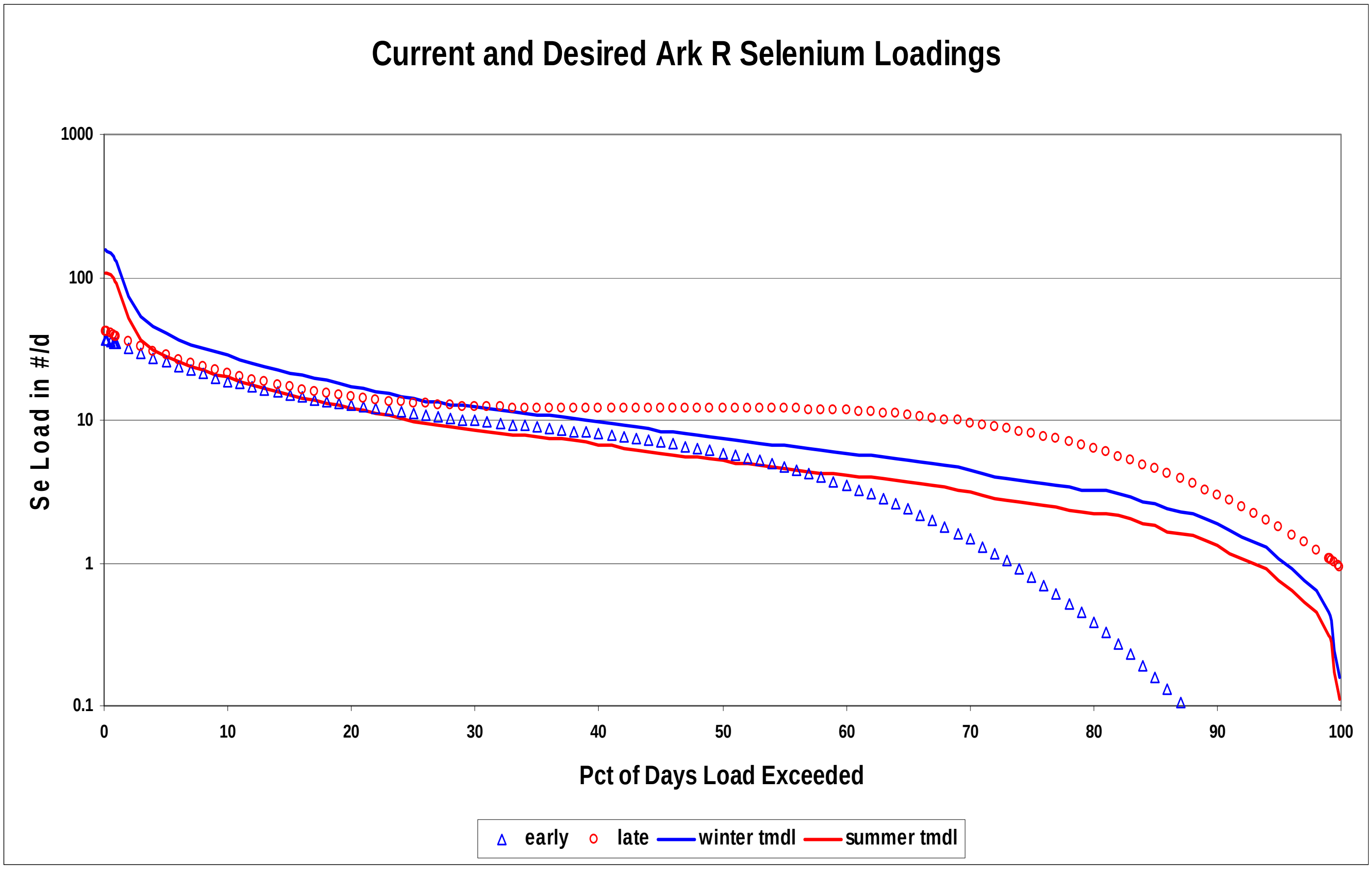

Figure 17. 1996-2001 & 2002-2006 Coolidge Loads Compared to TMDL Suggested Summer & Winter Loads

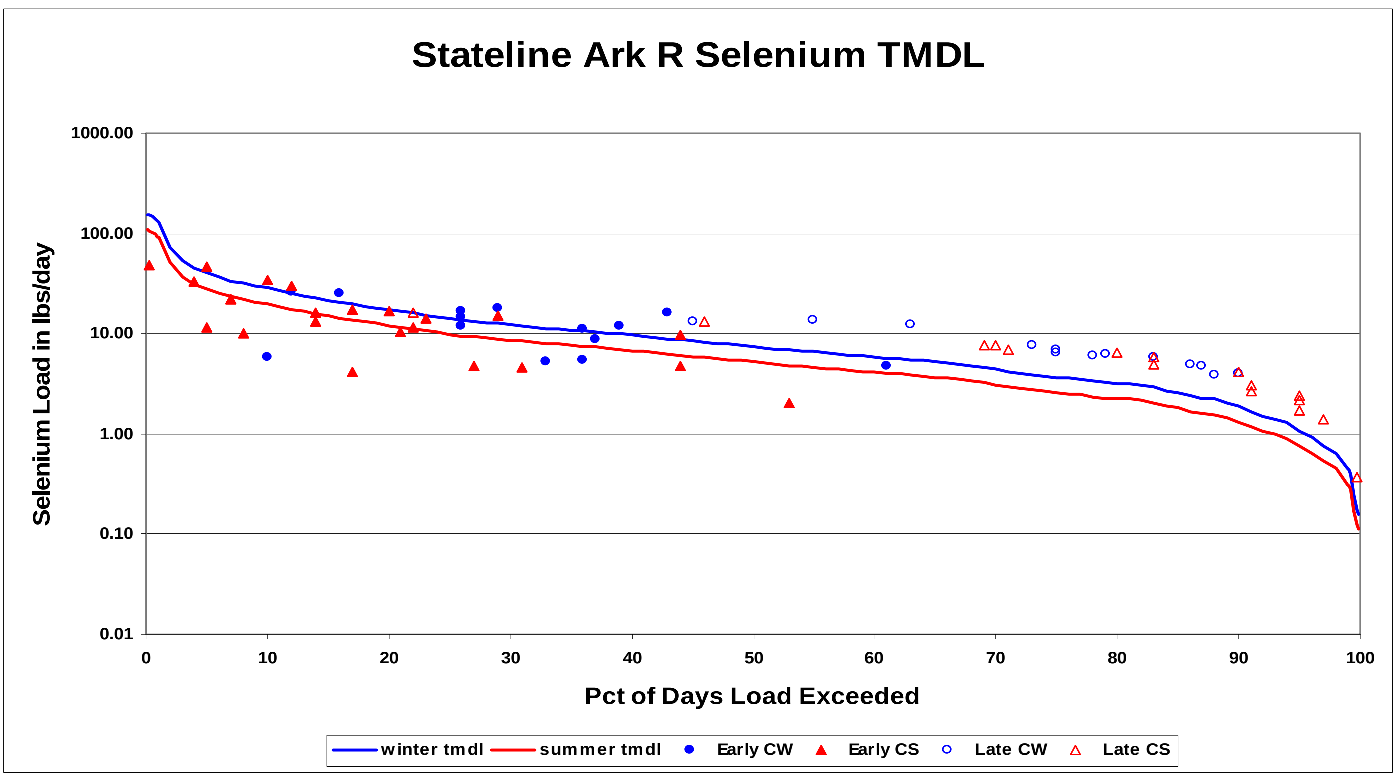

Figure 18. Sampled Coolidge Loads by Period and Season Compared to TMDL Summer & Winter Loads

Biology

In 2004, EPA proposed revised aquatic life criteria based on concentrations of selenium in whole-body fish tissue. The proposed chronic criterion is 7.91 ug Se/g dry weight for freshwater aquatic life. Additionally, if whole-body fish tissues concentrations exceed 5.85 ug Se/gram dry weight during the summer or fall, winter monitoring should ensue to determine if the chronic criterion is exceeded. Lemly (1993) observed less survival of bluegill at elevated selenium levels in lower temperature waters, hinting that the elevated selenium seen in the winter off-season on the Arkansas River might be problematic with the aquatic life residing within the river system. The results of that study directed the proposed values in fish tissue.

An acute criterion in the water column was also proposed for the two main forms of total recoverable selenium (selenite and selenate). Selenite was not to exceed 258 ug/l while selenate should not exceed a value expressed by: **exp(0.5812*ln(sulfate) + 3.357)**. At the sulfate ranges seen at the stateline (1900-2400 mg/l), the applicable acute selenate values would be 2310-2645 ug/l. These values are one to two orders of magnitude greater than current Kansas or Colorado acute criteria. Sulfate tends to reduce the toxicity of selenate, the most common form of selenium (EPA, 2004).

EPA has not finalized its guidance as to acceptable selenium levels within fish tissue nor the associated ambient water concentrations that relate to these critical levels.

The Kansas Biological Survey sampled sediment, fish tissue and water for selenium levels along the Arkansas River near Holly, CO, and Coolidge, Kendall and Lakin, Kansas in 2005 and 2006. Only Coolidge was sampled in winter (December 2005) and Lakin was only sampled in 2005 and fish fillets analyzed. Nine of the thirteen fish species collected had excessive selenium in their tissues, with the highest selenium levels (14.5 ug/l dw) found in a central stoneroller taken at Coolidge in May, 2006 **(Appendix A)**. Fathead minnow comprised the species with the highest percentage of excessive tissue selenium, followed by sand shiner and channel catfish. All other species had 25% or less of their individuals exceed the criterion. Only bullhead minnows, white suckers, green sunfish and plains killifish had selenium levels below the proposed criterion. Table 3 summarizes the fish selenium data found at Holly, Coolidge and Kendall. The largest number of fish with excessive selenium was at Coolidge, but the highest proportion of fish was downstream at Kendall. Proportionately fewer fish in Colorado had high selenium and the average and maximum tissue levels peaked at Coolidge.

Five of ten water samples exceeded 5 ug/l at the three locations, mostly in fall and winter **(Appendix B)**. Selenium was higher in the water at the upstream sites and selenium in the sediment peaked at Coolidge.

Location	# of Fish Sampled	# of Fish w/[Se] > 5.85 ug/g in May/Sept (Need Monitoring)	# of Fish w/ [Se] > 7.91ug/g Anytime (Chronic Criterion)	Average Tissue Se	Maximum Tissue Se
Holly	33	13 (39%)	5 (15%)	5.5 ug/g dw	10.7 ug/g
Coolidge	79	40 (51%)	22 (27%) [3 in December]	6.7 ug/g dw	14.5 ug/g
Kendall	49	28 (57%)	17 (34%)	6.3 ug/g dw	10.4 ug/g

Table 3: Summary of Fish Sampling and Excessive Selenium Levels in Fish Tissue

Desired Endpoint Condition of Water Quality on Upper Arkansas River over 2010-2016

Table 4 summarizes the average selenium levels seen at the three monitoring stations since 1996, by season. Even in the favorable wet period of the mid 1990's, concentrations tended to be over the chronic criterion of 5 ug/l. The current period is marked by significantly higher selenium and greater loss of streamflow above Garden City and Deerfield. Regression of concurrent samples at the three stations confirms a decrease in loads downstream from the Stateline (Table 5). Therefore, establishing a suitable endpoint at the Stateline will result in lower loads and concentrations in the river en route to Garden City. Some of the load loss may be due to diversion by irrigation ditches or infiltration into the alluvium via the river channel.

Because the period of 1996-2001 probably reflects the most favorable conditions in the river in terms of selenium concentrations, two seasonal endpoints of 7 ug/l from April to October and 10 ug/l from November to February will ultimately be used in this TMDL after their adoption in the Kansas Surface Water Quality Standards. Until that time, the TMDL will use the current chronic (5 ug/l) and acute (20 ug/l) criteria as the standards to be achieved.

Sta.#	Location	Season	1996-2001	#	#>5	#>20	2002-2006	#	#>5	#>20
223	**Coolidge**	**Winter**	**9.8 ppb**	**14**	**11**	**0**	**19.3 ppb**	**13**	**13**	**5**
223	**Coolidge**	**Summer**	**6.8 ppb**	**22**	**15**	**0**	**16.4 ppb**	**17**	**17**	**3**
598	Deerfield	Winter	9.7 ppb	14	12	0	17.9 ppb	6	6	1
598	Deerfield	Summer	6.0 ppb	22	13	0	15.8 ppb	5	5	0
286	*Pierceville*	*Winter*	*9.2 ppb*	*13*	*10*	*0*	*20.1 ppb*	*1*	*1*	*1*
286	*Pierceville*	*Summer*	*6.1 ppb*	*16*	*11*	*0*	*No sample*	*0*	*0*	*0*

Table 4. Average Period Seasonal Selenium Levels and Comparison to Existing Criteria

Season	Downstream Load	Upstream Load Regression	R^2	B/E*
Winter	Deerfield	0.781*Coolidge Load + 0.78	55%	3.6 #/d
Summer	Deerfield	0.690*Coolidge Load + 0.43	81%	1.4 #/d
Winter	Pierceville	0.895*Deerfield Load – 0.003	63%	0.003 #/d
Summer	Pierceville	0.916*Deerfield Load – 0.81	45%	0.9 #/d

Table 5. Selenium Load Regressions between Three KDHE Arkansas River Monitoring Sites

- *** B/E = Breakeven point: for Deerfield: where Coolidge load is greater than Deerfield load; for Pierceville: Deerfield Load where Pierceville load is greater than zero.**

Furthermore, once EPA establishes a fish tissue based criterion and associated ambient water column concentration translators, those will be incorporated in the Water Quality Standards and this TMDL. At this time, the proposed fish tissue criterion is exceeded for a number of species, indicating an impaired condition that coincides with the elevated selenium levels seen at the stateline since 2001. Establishment of the lower seasonal concentrations will likely result in lower selenium in the water column and the food chain and lower the selenium levels seen in fish tissue. The suggested seasonal endpoints are to be expressed as seasonal averages to mimic the long term exposure of aquatic life to excessively high levels of selenium, but offset the impact of isolated incidences of elevated selenium amidst acceptable ambient conditions. These endpoints will be realized through flows of better quality coming down river over time.

Emphasis will be placed on improving quality at the lower flows since the residence of time of selenium-laden water is extended during low flow conditions, rather than being swept downstream by higher flows.

3. SOURCE INVENTORY AND ASSESSMENT

NPDES: There are four NPDES permitted wastewater dischargers located along the Arkansas River between the Stateline and Pierceville (Table 6). One of these facilities is not operating because of damage from fire several years ago.

DISCHARGER	STREAM REACH	NPDES #	KANSAS PERMIT #	TYPE	DESIGN FLOW	EXPIRATION DATE	AVG Q/AVG/MAX Se
Garden City MWWTP	Arkansas River	KS0038962	M-UA14-OO01	Oxidation Ditches	6 MGD	June 30, 2011	3.0 MGD/2.56 ppb/4.56 ppb*
Sunflower Electric Power	Arkansas River	KS0080063	I-UA14-PO01	RO Reject & Blowdown	0.659 MGD	December 31, 2011	0.39 MGD/14 ppb/16.9 ppb*
Lakin MWWTP	Arkansas River	KS0094196	M-UA24-OO01	4-Cell Lagoon	0.314 MGD	January 31, 2011	NA/<50 ppb*
Swift Beef Company	Arkansas River	KS0092347	I-UA14-PO03	Anaerobic Lagoon/SBR/ Aerobic Lagoons**	2 MGD	December 31, 2007	NA/NA/NA

* Effluent Se values are based on detected levels, majority of samples were below detection limits (Garden City: 15 ppb; Sunflower: 10 ppb; Lakin: 50 ppb)

** Facility currently closed due to fire; permittee to notify KDHE 60 days before start-up

Table 6. NPDES Facilities Along Arkansas River between Stateline and Pierceville

A majority of the effluent samples had selenium below the detection limits of the analytical process used by the permitees. In all cases, these detection limits were above the 5 ppb chronic criterion of the water quality standards. Adjustments will need to be made to future lab reporting and monitoring requirements under these NPDES permits so that an accurate assessment of selenium levels in wastewater can be made.

Because of the depleted condition of the Arkansas River, the wastewater from these facilities only travels a short distance from their respective outfalls before infiltrating into the bed of the channel. Therefore, it is unlikely that any of this wastewater comprises the flows sampled at Deerfield or Pierceville, unless there is substantial flow in the river moving past Garden City. In that situation, the wastewater and its associated selenium will be dwarfed by the volume and selenium content of the river itself.

Selenium in wastewater will be the product of the selenium content of the facility source water and any processes that add selenium or concentrate selenium in the effluent through evaporation. The power plant west of Garden City follows this process, although, because of recycling and improvement in its source water supply, the volumes and loads from the power plant will be small. The effluent that does reach the Arkansas River infiltrates through the stream channel.

High levels of selenium are seen in the ground water and supply wells, particularly for those facilities close to the river. In 2004, the array of wells used by Garden City had selenium levels ranging from 1 ppb to 15 ppb, averaging 5.9 ppb. Garden City now employs a Reverse Osmosis system for its water supply to combat the high level of salinity found in its source water. The reject brine from the RO system is disposed through deep well injection. Lakin averaged 5.5 ppb in its wells during 2000 and 2004. Other municipal systems, such as Syracuse, Deerfield, Holcomb and Coolidge have similar levels in their source water, depending upon the proximity of the wells to the river and the extent of the river alluvium, which tends to spread laterally below Lakin. These facilities use non-discharging lagoons to handle their wastewater and do not contribute to the Arkansas River. Non-discharging facilities and facilities not associated with selenium discharges are listed in Appendix C.

The exception might be Coolidge, whose lagoon and wastewater are connected to the alluvium of the Arkansas River through leakage. Coolidge has a population of 85 people, producing a potential wastewater volume of 0.0085 MGD (0.013 cfs), 3-4 orders of magnitude less than the typical streamflow in the river coming over the Stateline. Coolidge’s source water selenium levels have been below 1 ppb in 2000 and 2004.

The three concrete plants in Syracuse, Holcomb and Garden City all direct any excess water to retention basins where the water evaporates or percolates into the ground. Monitoring reports from 2004 and 2005 indicate no discharge from these plants to the Arkansas River.

Table 7 indicates the estimated 2005 population over the five counties overlying the Arkansas River in Colorado and Kansas. The population densities indicate little demographic pressure in contributing wasteloads to the river, except at Lamar and Garden City, which has low selenium levels in its effluent (Table 6).

There are few point sources in Colorado between John Martin Dam and the Stateline. The City of Lamar, originally had a purported design flow of 1 MGD, but has not discharged since 1993 and now disposes wastewater through evaporation or land application. There are no effluent data readily available to Kansas to ascertain the selenium content of the wastewater from these facilities. However, the assignment of wasteload allocations to Colorado dischargers is not in the purview of Kansas. Colorado’s responsibility will be to ensure the Kansas water quality targets are met at the Stateline and how it manages its point and non-point sources to meet those targets is its concern. Given the relatively small volume of discharge from these point sources, it is likely they have no influence on the river water quality at the Stateline.

Kansas would be concerned if new or expanded facilities discharged to the lower segment of the Arkansas River in Colorado with a large selenium load. Such would be the case if a Reverse Osmosis plant were allowed to discharge its reject brine with elevated selenium and salts, to the Arkansas River. Similarly, a power plant discharging a highly saline effluent, reflecting multiple cycling of cooling water and forced evaporation, would be a concern to Kansas.

County	Population	Area	Density	Principal City	Population
Bent, CO	6314	1514 sq.mi	4.2/sq.mi	Las Animas	2631
Prowers, CO	13,973	1640 sq.mi	8.5/sq.mi	Lamar	8605
Hamilton, KS	2594	996 sq.mi	2.6/sq.mi	Syracuse	1824
Kearney, KS	4469	871 sq.mi	5.1/sq.mi	Lakin	2316
Finney, KS	39,097	1302 sq.mi	30.0/sq.mi	Garden City	28,451

Table 7. Estimated 2005 Population of Counties Overlying Upper Arkansas River

Water Use and Irrigation Return Flows: As indicated by the analysis is Section 2, return flows from irrigated lands in Colorado appear to be a primary factor in the elevated levels of salinity and selenium seen along the downstream reaches from John Martin Dam. Description of the irrigation patterns is provided in Appendix D. The land use map of the Upper Arkansas valley shows the distribution of irrigation canals and ditches along the river in Colorado. The river is the principal source of water for most irrigated lands in Colorado. Once the river enters Kansas, irrigation is restricted by dune sand to the south of the river. Irrigation by ditch water is restricted to the valley lands immediately adjacent to the river in Hamilton County. Most of the irrigation from river water occurs in adjacent Kearny County. Halfway through Kearny County, the river crosses the Bear Creek Fault and begins to interact with an expanded alluvium and the High Plains Aquifer. Proliferation of center pivot irrigation in the valley begins east of that junction and ground water becomes the predominant source of irrigation water. These water use patterns are reflected in the streamflow gains and losses indicated in Table 1. Corn and alfalfa are the dominant irrigated crops

Studies by Colorado State University on irrigated lands in Colorado's lower Arkansas River Valley estimate the selenium loading from ground water, tributaries and direct surface return flows averaged 54 pounds per mile in 2003-2004 and 75 pounds per mile in 2004-2005. Surface water concentrations along the Arkansas River ranged from 4-23 ppb Se over 2003-2005. Elevated selenium levels were typically associated with lower flows seen along the river below John Martin Dam. Once flows rose above 100 cfs, selenium concentrations tended to fall below 10 ppb. Summer flows contained less selenium than winter flows, likely reflecting the composition of the flows being dominated by summer releases or ground water return flows in the respective seasons. Ground water selenium ranged from 0.4 – 3760 ppb, with a median of 16 ppb, but the alluvial deposits tended to be fresher, ranging in selenium from 0.4-166 ppb with a median of 12 ppb.

The lower valley contains soils and unconsolidated deposits with horizontal hydraulic conductivity ranging from 0.001 m/d to 26.7 m/d. Salinity in the ground water of the lower valley is substantially higher than the ground water of the valley above John Martin Reservoir. Total dissolved solids typically jumped 800 –1100 mg/l from the upstream portions of the study area to the downstream end examined by the study.

Irrigating on lands with shallow water tables tended to produce the highest levels of soil salinity. The manner of irrigation also influenced the distribution of water in the valley. Greater application depths and infiltration depths resulted from flood-type surface irrigation than corresponding sprinkler applications. Also aggravating the water-logged situation on irrigated lands is the loss of surface water through the delivery canal systems. Seepage losses along the Amity, Buffalo and Lamar canals ranged from 0.2 – 1.4 cfs per mile.

Within Kansas, there are currently six active ditches upstream of Garden City that use Arkansas River water: Frontier, Amazon, Great Eastern, Southside, Farmers and Garden City canals. Two ditches, the Ft. Aubrey and Alamo ditches, are no longer active. The Frontier Ditch diverts water in Colorado and returns a portion of unused water to the river above Syracuse. The Amazon and Great Eastern Ditch divert water from the same headgate east of Kendall and convey water to the Lake McKinney area. Water for the Great Eastern Ditch moves through Lake McKinney to irrigate eastern Kearny County. The Amazon Ditch continues northeastward to the northeast portion of the county. Occasionally, these canals will return 5-10 cfs to the river for one to two days in order to clear the canals of debris at the upstream end. The Southside Ditch diverts water a few miles downstream from the Amazon/Great Eastern headgate and is commonly used as an alternative conveyance system for the Farmers and Garden City ditch service areas to avoid significant transit losses in the river between Kendall and Deerfield. Such water returns to the river just west of Deerfield and is diverted at the Farmers/Garden City headgate downstream of Deerfield to irrigate areas near Holcomb. Indications from the Division of Water Resources indicates that little tailwater returns from these ditches. An average of 59,516 af/yr have been diverted from surface water in Hamilton, Kearney and Finney counties since 1990, given a 120 day irrigation period, this would equate to about 250 cfs.

Ground water irrigation starts in earnest south of Lakin in Kearny County and becomes the prevalent practice in Finney County. This marks the area where the river overlies the High Plains Aquifer. Flows at Garden City reflect this usage as extended periods of low or no flow are recorded at the gage on the river south of town. Very little return flow comes from lands irrigated by wells, as tailwater control requirements are part of water rights overseen by the Division of Water Resources and Groundwater Management District No. 3.

Given that certain reaches of the river have historically had large transit losses through infiltration to the surrounding ground water, additional influence on the stream from the high density of water use within the alluvial corridor and surrounding High Plains Aquifer ensures that the river will be a losing stream from Syracuse eastward. Surrounding groundwater has typically had sulfate levels under 500 mg/l. The lack of fresh water inflow from the surrounding aquifer has left the alluvial aquifer subject to elevated salinity levels as river water has been induced downward into the unconsolidated deposits. Losses from the delivery ditches infiltrate to the surrounding ground water and elevate the levels of salinity and selenium found in those deposits, particularly on the north side of the river, as indicated by sulfate concentrations measured by the Kansas Geological Survey (Figure 19). Continued pumping of the aquifer at 1990's rates will further induce saline water laterally to the freshwater aquifers, including increased intrusion on the south side of the river.

Background Levels: Sulfate and selenium have certainly been elevated within the river for decades and it is likely that natural contributions from the interaction of the Arkansas River with gypsum and shale deposits in the Pierre Shale in eastern Colorado would elevate their respective concentrations above the water quality criteria for domestic water supply, livestock and aquatic life. However, the pattern of irrigation return flows has increased the river concentrations through evapotranspiration of fresh water and extended inundation and leaching of saline soils to aggravate the current impairments. Source water data from communities along the Arkansas River in Kansas indicate elevated selenium in certain wells since the mid-1990's, especially those in proximity to the river or influenced by infiltration of irrigation water along ditches and laterals. Typically shallow wells exhibit elevated sulfate, selenium and salinity, while deep wells continue to be influenced by the fresh water of the High Plains Aquifer. Some small amounts of selenium might come from outcrops of Graneros Shale and Niobrara Chalk in Hamilton and Kearny counties. Arkansas River water decreases in selenium within Kansas because the Pierre Shale is not present in the valley and the Niobrara Chalk outcrops at the headwaters of the small, ephemeral tributaries. Ground water might be influenced by local deposits of volcanic ash.

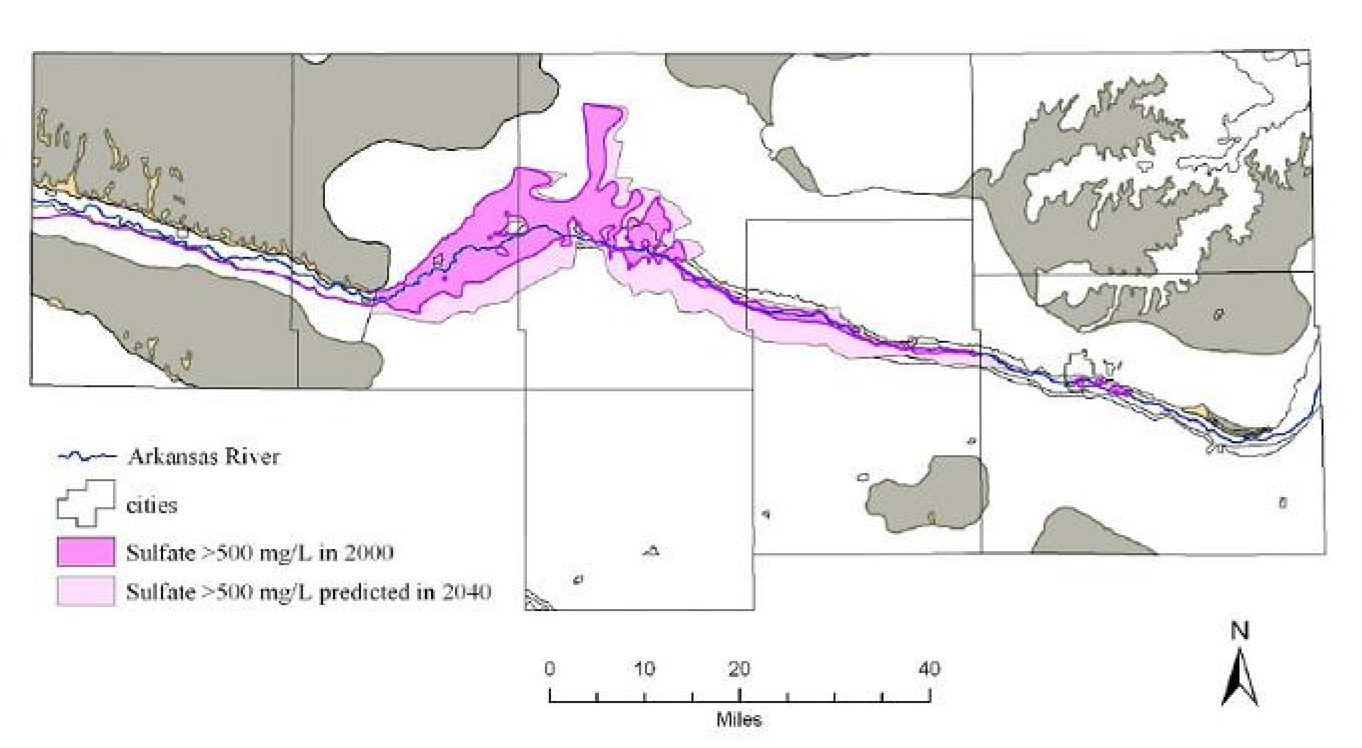

Figure 19. Existing and predicted distribution of sulfate in ground water along the Upper Arkansas River

4. ALLOCATION OF POLLUTION REDUCTION RESPONSIBILITY

The same mechanism that delivers high sulfate to the Arkansas River and the Stateline, likely contributes the high levels of selenium seen in recent years. Reductions in selenium will require two things: 1) Improved availability of water in the basin to provide an improved dilution base; and 2) Less interaction of river water with the valley lands and its associated soil and geologic salinity. As seen in Section 2, ultimate achievement of the existing selenium chronic criterion is not likely to occur, even with improved hydrologic conditions as seen in 1996-2001. Therefore, the TMDL will be staged in anticipation of alternative background concentrations replacing the existing criterion at the next triennial review of surface water quality standards.

Point Sources: Unless point sources act to concentrate salts through reuse and evaporation or using processes such as reverse osmosis, they will tend to discharge water that is similar in selenium content to their source water. The four existing and potential point source contributors will be expected to put out an effluent that is less than the background concentrations designated for the river. Table 8 lists the Wasteload Allocations that will be assigned to these point sources. Because of the dominant flow volume and elevated levels of stateline river selenium, relative to point source contributions, Wasteload Allocations will not bring attainment of water quality standards for selenium. In fact, wastewater discharges likely provide a flow base and dilution opportunities on the river. Because of the depletion of the Arkansas River between Lakin and Garden City, at best, the low flows that appear at the downstream Pierceville station will be at or under the combined design flows of the four facilities of Table 7. Thus, the hydrograph will be dominated by flows below 15 cfs, with a few episodic high flow events. The TMDL will be the Wasteload Allocation under those conditions.

Facility	Design Flow in MGD	Expected Selenium (ppb)	Wasteload Allocation in pounds per day
Garden City	6.0 MGD (9.28 cfs)	5 ppb	0.25 #/d
Sunflower Electric	0.65 MGD (1.02 cfs)	10 ppb	0.06 #/d
Lakin	0.314 MGD (0.49 cfs)	5 ppb	0.01 #/d
Swift Beef	2.0 MGD (3.09 cfs)	10 ppb	0.17 #/d
Totals	**8.97 MGD (15 cfs)**	**6.5 ppb (flow wt avg)**	**0.49 #/d**

Table 8. Wasteload Allocations of Selenium for Arkansas River Dischargers

Non-Point Sources: The primary cause of the elevated selenium along the Arkansas River is the natural contribution from the geology and soils of the drainage area in the valley aggravated by the historic pattern of irrigation return flow along the river, a non-point source. The river flow at the Stateline is the cap of Load Allocations seen in the Kansas portion of the river, since the river begins to lose flow to diversion and infiltration as it leaves Hamilton County (Figure 20). Therefore, the TMDL curve at Garden City/Pierceville will be marked by lower loads and a potential dominance of the Wasteload Allocation over half the time (Figure 21).

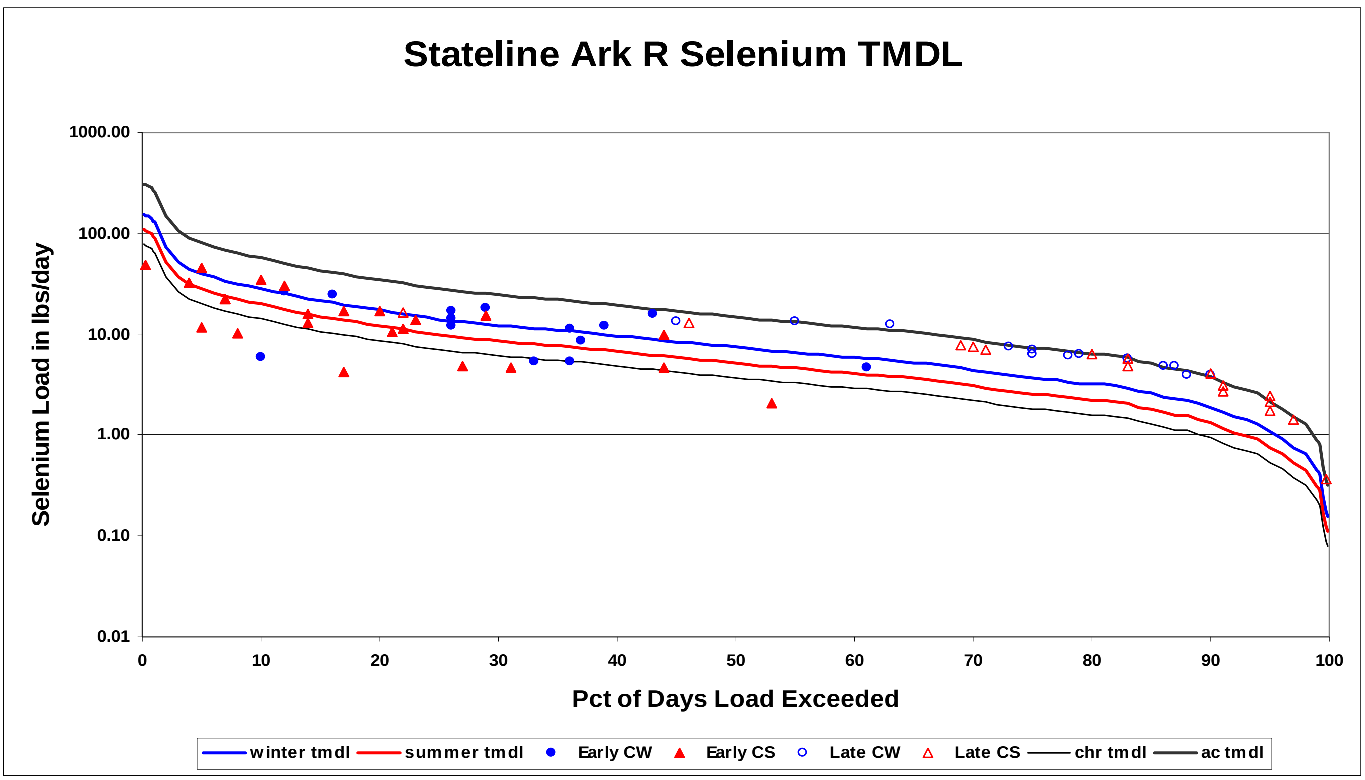

Figure 20. Arkansas River Stateline Selenium TMDL

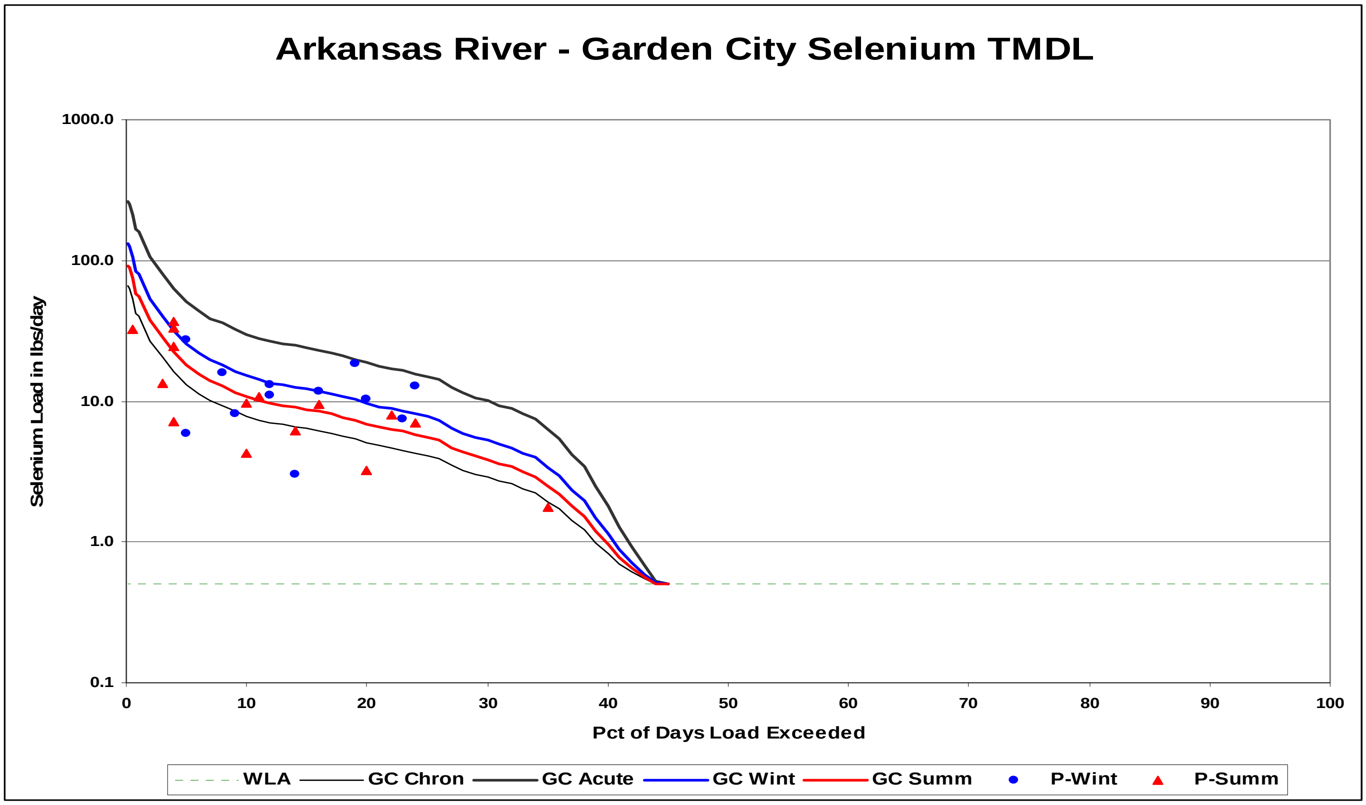

Figure 21. Arkansas River at Garden City/Pierceville Selenium TMDL

Table 9 displays the Load Allocations at various flow conditions at the Stateline and at Pierceville. Each flow condition roughly produces a doubling of the load from the previous lower flow condition. Current Stateline conditions will need to be reduced from the acute criterion loading levels to average levels lying between or below the winter and summer loading capacities. Once those reductions are made, there will be more opportunities to see river selenium concentrations in the river fall below the current chronic criterion of 5 ppb. Once favorable flow conditions return to the Arkansas River and streamflows move past Garden City, the selenium levels at Pierceville will also likely remain below the winter and summer loading capacities because of dilution.

	Arkansas River at the Stateline			**Arkansas River below Garden City**			
Flow Condition	**Chronic L.A. (5 ppb)**	**Winter L.A (10 ppb)**	**Summer L.A. (7 ppb)**	**Chronic L.A. (5 ppb)**	**Winter L.A. (10 ppb)**	**Summer L.A. (7 ppb)**	**W.L.A.**
Low (90%)	0.9 #/d	1.9 #/d	1.3 #/d	0.0 #/d	0.0 #/d	0.0 #/d	0.5 #/d
Dry (75%)	1.8 #/d	3.7 #/d	2.6 #/d	0.0 #/d	0.0 #/d	0.0 #/d	0.5 #/d
Normal (50%)	3.7 #/d	7.5 #/d	5.2 #/d	0.0 #/d	0.0 #/d	0.0 #/d	0.5 #/d
Wet (25%)	7.0 #/d	14.0 #/d	9.8 #/d	3.6 #/d	7.2 #/d	5.1 #/d	0.5 #/d
High (10%)	14.3 #/d	28.6 #/d	20.0 #/d	7.3 #/d	14.6 #/d	10.2 #/d	0.5 #/d

Table 9. Load Allocations Along Arkansas River Under Current and Future Criteria

Defined Margin of Safety: The Margin of Safety accounts for the lack of knowledge between water quality and effluent limitations. Since this impairment is primarily caused by non-point sources, effluent limitations are meaningless. Nonetheless, there is uncertainty in reducing selenium loads so that the current or proposed criteria are met in the river. An explicit measure would be the fish tissue concentrations of selenium in fish within the river. EPA has proposed a fish tissue concentration of 7.91 ug/g as a criterion for selenium. This TMDL will use that value as an explicit Margin of Safety that assures the aquatic life support use of the Upper Arkansas River is being supported by load reductions of selenium necessary to lower ambient concentrations in the stream to the desired endpoints.

State Water Plan Implementation Priority: This TMDL will be a **High** Priority for implementation because of the need to restore background concentrations and reduce overall salinity present in the river as it enters Kansas. Since the mechanisms that will abate selenium loading will also reduce salinity loads, multiple benefits to the uses of the river will accrue through implementation of this TMDL.

Unified Watershed Assessment Priority Ranking: This watershed lies within the Middle Arkansas-Lake McKinney Subbasin (HUC 8: 11030001) with a priority ranking of 31 (Medium Priority for restoration work).

Priority HUC 11s and Stream Segments: Because the selenium is being loaded to the river by irrigation and water management practices in Colorado, the valley between John Martin Reservoir and the Stateline will be the area of emphasis for selenium and salinity control. The alluvial valley of the Arkansas River in Hamilton, Kearney and Finney Counties in Kansas will be the priority area to implement protective practices that will curtail the loading of salts and selenium into the ground water supplies of the alluvium and underlying High Plains Aquifer.

5. IMPLEMENTATION

Desired Implementation Activities: Implementation activities intending to reduce salinity and selenium in the Arkansas River will benefit from practices that minimize the interaction of releases from John Martin Reservoir and the soil profile and underlying geology of the irrigated valley lands. Improved water quality will be realized from more direct delivery of flow from John Martin to the Stateline. Substantially improved water quality will occur during periods of adequate water supply and any sequence of higher quality water at high flows will improve long-term averages in selenium and sulfate in the Arkansas River. Any practices need to consider consequences to the protocols and procedures of the Arkansas River Compact between Kansas and Colorado and delivery obligations to water users in the lower valley, including Kansas.

1. Condition necessary state and federal discharge permits to monitor effluent selenium levels, and, if wastewater contains significant loads of selenium, apply appropriate effluent limits.
2. Replace existing water quality standards for selenium with appropriate seasonal background concentrations reflecting natural processes and confirm designated uses along the river.
3. Provide alternate operations and delivery of water from Colorado to Kansas that improves water quality, but does not create violations of the Arkansas River Compact.
4. Ensure the availability of occasional high flows to spill from John Martin Reservoir and reduce selenium levels throughout Arkansas River stream-aquifer system.

5. Develop long term plan for irrigation return flow and water management to reduce sulfate and selenium loadings and implement improved management practices.
6. Increase conservation of water in the valley, within the context of the Kansas Water Appropriation Act and reduce phreatophyte loss of water along channel.
7.Enroll river corridor lands in the Conservation Reserve Enhancement Program to reduce ground water pumping stress in Kansas on Arkansas River streamflows.

Implementation Programs Guidance

NPDES and State Permits - KDHE

a. Direct existing municipal and industrial permitted facilities along river to monitor selenium levels in effluent at detection levels at or below 5 μg/l.
b. Condition existing permits for facilities with significant impact from high selenium effluent to reduce or eliminate selenium loadings after 2011.
c. Apply appropriate effluent limits on discharges from future facilities with significant selenium content, including Reverse Osmosis processes and electrical generating power plants.
d. Coordinate new permits to renew after 2011 in concert with existing permits discharging to the Arkansas River to facilitate allocation of current and future wasteloads.

Water Quality Standards and Assessment - KDHE

a. Confirm designated uses of special aquatic life, domestic water supply and livestock watering on Arkansas River.
b. Replace existing selenium criteria with seasonal background concentrations of selenium for the Arkansas River between Coolidge and Pierceville, in accord with the second stage endpoints of this TMDL (7 μg/l summer; 10 μg/l winter) in 2008.

Watershed Planning - KDHE

a. Work with Colorado Water Quality Control Division to share planning information, research results, and collaborate on a joint Targeted Watershed Grant to address the salinity issues of the Arkansas River.
b. Encourage EPA to finalize selenium criteria for aquatic life, including fish tissue criteria and corresponding water column concentration translators.
c. Collaborate with Colorado on a comprehensive irrigation and water management plan for reduction in sulfate and selenium loadings, including:
   i. Reducing recharge from over-application of irrigation water
   ii. Improved irrigation scheduling and monitoring of irrigation volumes
   iii. Reduced irrigation application rates
   iv. Replacing flood/ditch irrigation with gated pipe, surge valves, drip irrigation and sprinklers
   v. Land leveling
   vi. Reduction of seepage from irrigation canals via canal liners, soil amendments and additives, plastic membranes and other lining material.
   vii. Increasing pumping rates of existing wells directing excess

water to Arkansas River.

viii. Installation of horizontal subsurface drains with variable depth and drain spacing, alternative collection networks and pumping stations, temporary off-channel storage for subsequent release to river.

ix. Lowering river channel through dredging to encourage rapid drainage of ground water to river, reducing residence time in soil.

x. Eradication of tamarisk and other phreatophytes to enhance hydrologic budget.

d. Monitor real-time conductivity of Arkansas River at Coolidge for further characterization of seasonal selenium and flow conditions.

Arkansas River Compact - Division of Water Resources

a. Evaluate new delivery mechanisms and procedures as allowed by the Compact and actions of the Compact Administration.

b. Examine opportunities to deliver Compact water from John Martin Reservoir directly down the river to the Stateline without diversion onto Colorado lands by upstream ditches

c. Insure that occasional spills from John Martin Reservoir are available to provide restorative dilution and flushing flows to downstream reaches.

d. Examine opportunities to utilize water savings in Kansas to improve delivery of higher quality water at Stateline in Colorado.

e. Assist KDHE in collaborative efforts with Colorado on opportunities to reduce phreatophytic water use, increase water conservation and improve the quality of irrigation return flows consistent with the Arkansas River Compact.

Water Appropriations - Division of Water Resources

a. Reduce remaining tailwater entering river within Kansas.

b. Promote water conservation techniques in surface and ground water irrigation

Subbasin Water Management - Division of Water Resources

a. Evaluate the interaction of the Arkansas River flows and the surrounding aquifer:

i. between Garden City and Pierceville

ii. between the headgate of the furthest downstream ditch and Garden City

Water Planning - Kansas Water Office

a. Coordinate enrollment of irrigation lands along Upper Arkansas River into Conservation Reserve Enhancement Program to reduce ground water pumping and inducement of saline river water into alluvial and High Plains Aquifer.

b. Initiate pilot studies to eradicate phreatophytes and associated consumptive use along Kansas portion of Arkansas River above Lakin

c. Direct any additional funds available within the Water Conservation Projects Fund to water management and conservation activities along the Arkansas River within Ground Water Management District No. 3.

Timeframe for Implementation: Corrdination with Colorado over water quality planning, monitoring and assessment, non-point source abatement and CSU research findings should occur in November 2007. Implementation through an EPA joint Targeted Watershed Grant should begin in 2009. Integration of water quality management, potentially involving irrigation return flows and administration and operations of the Arkansas River Compact should begin in 2012.

Targeted Participants: Primary participants for implementation will be the state agencies in the two states with responsibilities for water right administration and water quality management. The irrigation ditches in both states will be involved in any return flow management plans. The Colorado Water Quality Control Commission has incorporated the salinity issue into its 2007 revision of water quality standards for the Arkansas River. The Statement of Basis and Purpose regarding the Kansas issue is included in Appendix E. The Colorado Division of Water Quality Control is directed to work with Kansas on standards, Use Attainability Analyses, TMDLs and implementation of remedial actions to reduce the loading of selenium throughout the basin.

Milestone for 2011: The year 2011 marks the next visitation cycle into the Upper Arkansas Basin for TMDL revision and development. At that time, NPDES permits should be renewed with appropriate treatment and monitoring conditions, a comprehensive irrigation management plan should be implementing improved management practices in the valley lands below John Martin Reservoir and irrigated lands along the Arkansas River in Kansas should be enrolled in the CREP program. Additionally, selenium data at the Stateline should indicate closer association with concentrations released from John Martin Reservoir and lower concentrations than that seen over 2002-2006. Finally, selenium background concentrations should be in place with the Kansas Water Quality Standards, replacing the current chronic criterion of 5 ppb.

Delivery Agents: The primary delivery agents for program participation will be the Division of Water Resources and the Kansas Department of Health and Environment.

Reasonable Assurances:

Authorities: The following authorities may be used to direct activities along the river to reduce pollution.

1. K.S.A. 65-164 and 165 empowers the Secretary of KDHE to regulate the discharge of sewage into the waters of the state.

2. K.S.A. 65-171d empowers the Secretary of KDHE to prevent water pollution and to protect the beneficial uses of the waters of the state through required treatment of sewage and established water quality standards and to require permits by persons having a potential to discharge pollutants into the waters of the state.

3. K.A.R. 28-16-69 to -71 implements water quality protection by KDHE through the establishment and administration of critical water quality management areas on a watershed basis.

4. K.S.A. 82a-901, et seq. empowers the Kansas Water Office to develop a state water plan directing the protection and maintenance of surface water quality for the waters of

the state.

5. K.S.A. 82a-1803 creates the Water Conservation Projects Fund to be administered by the Kansas Water Office for water conservation and water use efficiency projects in the Upper Arkansas River Basin impacted by the Arkansas River Compact.
6. The *Kansas Water Plan* and the Upper Arkansas Basin Plan provide the guidance to state agencies to coordinate programs intent on protecting water quality and to target those programs to geographic areas of the state for high priority in implementation.

7. K.S.A. 82a-520 contains the Arkansas River Compact between Colorado and Kansas, including the provisions for administering the delivery of water between the states..

8. K.S.A. 82a-701, et seq. authorizes the Chief Engineer and the Division of Water Resources to administer water appropriations in the state, including prevention of waste and planning and practicing water conservation.

Funding: The Water Conservation Projects Fund has received about $9.8 million in funds recovered through the litigation over the Arkansas River Compact. The Fund is to be used for projects involving efficiency improvements to canals, water use efficiency devices, tailwater systems of irrigation system efficiency upgrades, monitoring equipment, artificial recharge or water right purchase and maintenance of the Arkansas River channel.

Other protection or planning activities are incorporated within the Upper Arkansas Basin Plan of the *Kansas Water Plan*. The state water planning process, overseen by the Kansas Water Office, coordinates and directs programs and funding toward watersheds and water resources of highest priority. Typically, the state allocates a portion of the $16-18 million available annually from the State Water Plan Fund to water quality and water conservation projects and programs.

The 2007 Kansas Legislature authorized $2 million for implementation of the Conservation Reserve Enhancement Program along the Arkansas River, enrolling up to 40,000 acres and retiring water rights to save an estimated 59,500 acre-feet.

Many of the implementation practices must occur in Colorado to reduce the loading of selenium in the Arkansas River. Similar efforts in the Gunnison Basin, where piping irrigation water in place of ditch delivery over 30 miles costs in excess of $1.7 million.

EPA Targeted Watershed Grants were funded at $16.6 million in FFY06 and $6.93 million in FFY07. Typically 10-12 targeted watersheds are funded each year.

Effectiveness: Irrigation return flow controls are expensive to implement, although tailwater management has been practiced in Kansas for decades. Replacement of 8.5 miles of ditches and laterals with piping in the Gunnison Basin of Colorado reduced selenium loads by 27%. However, to achieve an overall reduction of over half existing selenium loads, over 200 miles of ditch system must be replaced. Therefore, any implementation will have to occur over the long-term of 10-15 years to achieve reduction in loading from valley irrigated lands. The requirements of the Arkansas River Compact complicate the ability of Colorado to achieve the endpoints expected by this TMDL.

Should bi-state cooperation lag below expectations over 2007-2011 and hinder progress in improving water quality conditions from those seen over 2002-2006, the federal government may impose more stringent conditions on the states in order to meet the desired endpoints expressed in this TMDL.

6. MONITORING

KDHE should collect bimonthly samples at Stations 223, 598 and 286 over 2007-2015 in order to assess progress in implementing this TMDL over the two defined seasons. During the evaluation period after 2011, more targeted biological sampling may need to be conducted in fall and winter to assess selenium accumulations in fish tissue. Use of the real time flow data available at the Coolidge and Garden City stream gaging stations can direct sampling efforts. Additionally, support of a real time conductivity probe at the Coolidge gage will allow additional analysis of the inter-relationship between selenium levels and flows arriving from Colorado.

Monitoring of selenium levels in effluent, at detection limits below 5 μg/l, will be a condition of NPDES and state permits for facilities discharging to the Arkansas River.

Water use, tailwater returns and streamflow gains and losses along the Arkansas River will be monitored by the Division of Water Resources.

7. FEEDBACK

Public Meetings: Public meetings to discuss TMDLs on the Upper Arkansas River have been held since 2000 in Garden City. An active Internet Web site was established at www.kdheks.gov/tmdl/ to convey information to the public on the general establishment of TMDLs in the Upper Arkansas Basin and this specific TMDL on the Arkansas River. Additionally, meetings were held in 2005 & 2006 with Ground Water Management District No.3, the Associated Ditches of Kansas and the Kansas Water Congress.

Public Hearing: A Public Hearing on this Upper Arkansas Basin TMDL was held in Garden City on June 6, 2007.

Basin Advisory Committee: The Upper Arkansas Basin Advisory Committee met to discuss this TMDL on October 17, 2005 in Jetmore, February 27, 2006 in Great Bend, June 13, 2006 in Coolidge, October 12, 2006 in Kinsley, December 5, 2006 in Jetmore, March 6, 2007 in Jetmore and May 10, 2007 in Garden City.

Interaction with Colorado: Testimony was given to the Colorado Water Quality Control Commission on Arkansas River selenium issues at a Issues Formulation Hearing on November 13, 2006 in Alamosa and Surface Water Quality Standards Hearing on June 11, 2007 in Pueblo.

Milestone Evaluation: In 2011, evaluation will be made as to implementation of management practices that improve water quality of flows on the Arkansas River between John Martin and the Stateline. Disposition of alternative Water Quality Standards for selenium in both states will be evaluated, in light of selenium criteria for aquatic life recommended by EPA.

Consideration for 303d Delisting: The river will be evaluated for delisting under Section 303d, based on the monitoring data over the period 2008-2015. Therefore, the decision for delisting will come about in the preparation of the 2016 303d list. Should modifications be made to the applicable water quality criteria during the implementation period, consideration for delisting, desired endpoints of this TMDL and implementation activities may be adjusted accordingly.

Incorporation into Continuing Planning Process, Water Quality Management Plan and the Kansas Water Planning Process: Under the current version of the Continuing Planning Process, the next anticipated revision would come in 2007 which will emphasize revision of the Water Quality Management Plan. At that time, incorporation of this TMDL will be made into both documents. Recommendations of this TMDL will be considered in *Kansas Water Plan* implementation decisions under the State Water Planning Process for Fiscal Years 2008-2015.

TMDL Revised October 18, 2007

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Appendix A: Fish Tissue Selenium Concentrations from Arkansas River by Kansas Biological Sampling 2005-2006

Sampling Site	Fish Species	Sampling Date	Part Analyzed	Selenium (µg/g dw)
Kendall	channel catfish	09/07/05	whole body	5.7
	bullhead minnow	05/19/06	whole body	3.4
	bullhead minnow	05/19/06	whole body	4.6
	central stoneroller	05/19/06	whole body	2.5
	central stoneroller	05/19/06	whole body	2.8
	central stoneroller	05/19/06	whole body	0.9
	fathead minnow	05/19/06	whole body	6.7
	fathead minnow	05/19/06	whole body	**8.4**
	fathead minnow	05/19/06	whole body	**9.9**
	fathead minnow	05/19/06	whole body	**8.4**
	fathead minnow	05/19/06	whole body	**8.0**
	fathead minnow	05/19/06	whole body	**9.3**
	plains killifish	05/19/06	whole body	2.5
	red shiner	05/19/06	whole body	4.1
	sand shiner	05/19/06	whole body	**9.0**
	central stoneroller	09/11/06	whole body	**9.4**
	central stoneroller	09/11/06	whole body	6.0
	central stoneroller	09/11/06	whole body	**7.9**
	central stoneroller	09/11/06	whole body	6.6
	central stoneroller	09/11/06	whole body	7.5
	common carp	09/11/06	whole body	**10.3**
	common carp	09/11/06	whole body	**9.0**
	common carp	09/11/06	whole body	2.7
	gizzard shad	09/11/06	whole body	3.6
	gizzard shad	09/11/06	whole body	5.6
	gizzard shad	09/11/06	whole body	**10.4**
	plains killifish	09/11/06	whole body	5.8
	plains killifish	09/11/06	whole body	4.9
	plains killifish	09/11/06	whole body	7.0
	plains killifish	09/11/06	whole body	6.0
	plains killifish	09/11/06	whole body	4.2
	plains killifish	09/11/06	whole body	5.5
	plains killifish	09/11/06	whole body	5.1
	red shiner	09/11/06	whole body	4.5
	red shiner	09/11/06	whole body	4.8
	red shiner	09/11/06	whole body	**10.1**
	red shiner	09/11/06	whole body	5.4
	red shiner	09/11/06	whole body	3.6
	red shiner	09/11/06	whole body	5.7
	sand shiner	09/11/06	whole body	7.8
	sand shiner	09/11/06	whole body	7.3
	sand shiner	09/11/06	whole body	**8.1**
	sand shiner	09/11/06	whole body	6.3
	sand shiner	09/11/06	whole body	7.7
	sand shiner	09/11/06	whole body	6.0
	sand shiner	09/11/06	whole body	**9.7**
	sand shiner	09/11/06	whole body	**8.0**
	sand shiner	09/11/06	whole body	**8.8**
	sand shiner	09/11/06	whole body	**8.4**

Sampling Site	Fish Species	Sampling Date	Part Analyzed	Selenium (µg/g dw)
Coolidge	channel catfish	09/07/05	whole body	6.6
	channel catfish	09/07/05	whole body	**11.3**
	channel catfish	09/07/05	whole body	7.8
	channel catfish	09/07/05	whole body	4.1
	channel catfish	09/07/05	whole body	**12.3**
	channel catfish	09/07/05	whole body	**7.9**
	plains killifish	09/07/05	whole body	4.3
	western mosquitofish	09/07/05	whole body	3.3
	plains killifish	12/15/05	whole body	5.4
	plains killifish	12/15/05	whole body	4.2
	plains killifish	12/15/05	whole body	5.7
	red shiner	12/15/05	whole body	7.0
	red shiner	12/15/05	whole body	4.3
	red shiner	12/15/05	whole body	5.7
	sand shiner	12/15/05	whole body	6.0
	sand shiner	12/15/05	whole body	**8.8**
	sand shiner	12/15/05	whole body	7.4
	sand shiner	12/15/05	whole body	3.7
	sand shiner	12/15/05	whole body	**8.0**
	sand shiner	12/15/05	whole body	7.3
	sand shiner	12/15/05	whole body	6.3
	sand shiner	12/15/05	whole body	5.0
	sand shiner	12/15/05	whole body	7.1
	sand shiner	12/15/05	whole body	6.1
	sand shiner	12/15/05	whole body	3.1
	sand shiner	12/15/05	whole body	5.5
	sand shiner	12/15/05	whole body	4.7
	sand shiner	12/15/05	whole body	**11.9**
	central stoneroller	05/19/06	whole body	**14.5**
	channel catfish	05/19/06	whole body	5.5
	fathead minnow	05/19/06	whole body	**10.9**
	fathead minnow	05/19/06	whole body	**7.9**
	fathead minnow	05/19/06	whole body	**9.9**
	fathead minnow	05/19/06	whole body	2.7
	red shiner	05/19/06	whole body	8.3
	red shiner	05/19/06	whole body	5.2
	red shiner	05/19/06	whole body	**9.5**
	red shiner	05/19/06	whole body	6.8
	sand shiner	05/19/06	whole body	3.9
	sand shiner	05/19/06	whole body	**9.0**
	sand shiner	05/19/06	whole body	7.3
	sand shiner	05/19/06	whole body	**8.9**
	sand shiner	05/19/06	whole body	**9.7**
	sand shiner	05/19/06	whole body	**9.0**
	sand shiner	05/19/06	whole body	**11.3**
	sand shiner	05/19/06	whole body	**11.1**
	sand shiner	05/19/06	whole body	**9.3**

	suckermouth minnow	05/19/06	whole body	2.9
	suckermouth minnow	05/19/06	whole body	6.1
	suckermouth minnow	05/19/06	whole body	6.4
	suckermouth minnow	05/19/06	whole body	7.0
	suckermouth minnow	05/19/06	whole body	6.0
	suckermouth minnow	05/19/06	whole body	**10.0**
	white sucker	05/19/06	whole body	3.5
	plains killifish	09/11/06	whole body	4.9
	plains killifish	09/11/06	whole body	4.7
	plains killifish	09/11/06	whole body	6.0
	plains killifish	09/11/06	whole body	5.6
	plains killifish	09/11/06	whole body	6.7
	plains killifish	09/11/06	whole body	4.2
	plains killifish	09/11/06	whole body	5.6
	plains killifish	09/11/06	whole body	5.1
	red shiner	09/11/06	whole body	7.1
	red shiner	09/11/06	whole body	6.8
	red shiner	09/11/06	whole body	5.8
	red shiner	09/11/06	whole body	4.7
	red shiner	09/11/06	whole body	7.0
	red shiner	09/11/06	whole body	6.7
	red shiner	09/11/06	whole body	**9.2**
	sand shiner	09/11/06	whole body	7.8
	sand shiner	09/11/06	whole body	**8.4**
	sand shiner	09/11/06	whole body	6.3
	sand shiner	09/11/06	whole body	7.0
	sand shiner	09/11/06	whole body	**8.5**
	western mosquitofish	09/11/06	whole body	4.7
	western mosquitofish	09/11/06	whole body	3.9
	western mosquitofish	09/11/06	whole body	3.4
	western mosquitofish	09/11/06	whole body	3.1
	western mosquitofish	09/11/06	whole body	4.4
	common carp	09/07/05	skin-on fillet	1.2
	common carp	09/07/05	skin-on fillet	7.8
	green sunfish	09/07/05	skin-on fillet	3.9
	channel catfish	05/19/06	skin-on fillet	5.3
	channel catfish	05/19/06	skin-on fillet	5.2
	channel catfish	05/19/06	skin-on fillet	3.1
	channel catfish	05/19/06	skin-on fillet	3.7
	common carp	05/19/06	skin-on fillet	3.6
	common carp	05/19/06	skin-on fillet	5.9
	green sunfish	05/19/06	skin-on fillet	2.2

Sampling Site	Fish Species	Sampling Date	Part Analyzed	Selenium (µg/g dw)
Holly	central stoneroller	05/19/06	whole body	1.7
	channel catfish	05/19/06	whole body	**10.4**
	plains killifish	05/19/06	whole body	1.1
	plains killifish	05/19/06	whole body	4.8
	red shiner	05/19/06	whole body	4.5
	western mosquitofish	05/19/06	whole body	**8.0**
	western mosquitofish	05/19/06	whole body	**8.8**
	western mosquitofish	05/19/06	whole body	6.9
	central stoneroller	09/11/06	whole body	4.4
	central stoneroller	09/11/06	whole body	2.2
	channel catfish	09/11/06	whole body	**10.7**
	gizzard shad	09/11/06	whole body	6.9
	plains killifish	09/11/06	whole body	4.3
	plains killifish	09/11/06	whole body	4.3
	plains killifish	09/11/06	whole body	5.3
	plains killifish	09/11/06	whole body	4.9
	plains killifish	09/11/06	whole body	6.7
	plains killifish	09/11/06	whole body	5.8
	plains killifish	09/11/06	whole body	3.8
	red shiner	09/11/06	whole body	6.2
	red shiner	09/11/06	whole body	3.8
	red shiner	09/11/06	whole body	5.2
	red shiner	09/11/06	whole body	3.9
	red shiner	09/11/06	whole body	6.3
	red shiner	09/11/06	whole body	5.0
	red shiner	09/11/06	whole body	6.1
	red shiner	09/11/06	whole body	**8.6**
	red shiner	09/11/06	whole body	6.8
	sand shiner	09/11/06	whole body	6.4
	sand shiner	09/11/06	whole body	6.6
	sand shiner	09/11/06	whole body	5.1
	western mosquitofish	09/11/06	whole body	2.8
	western mosquitofish	09/11/06	whole body	3.5
	central stoneroller	05/19/06	skin-on fillet	4.5
	channel catfish	05/19/06	skin-on fillet	6.1

Appendix B: Selenium Concentrations in Sediment and Water at Locations of Fish Sampling by Kansas Biological Survey

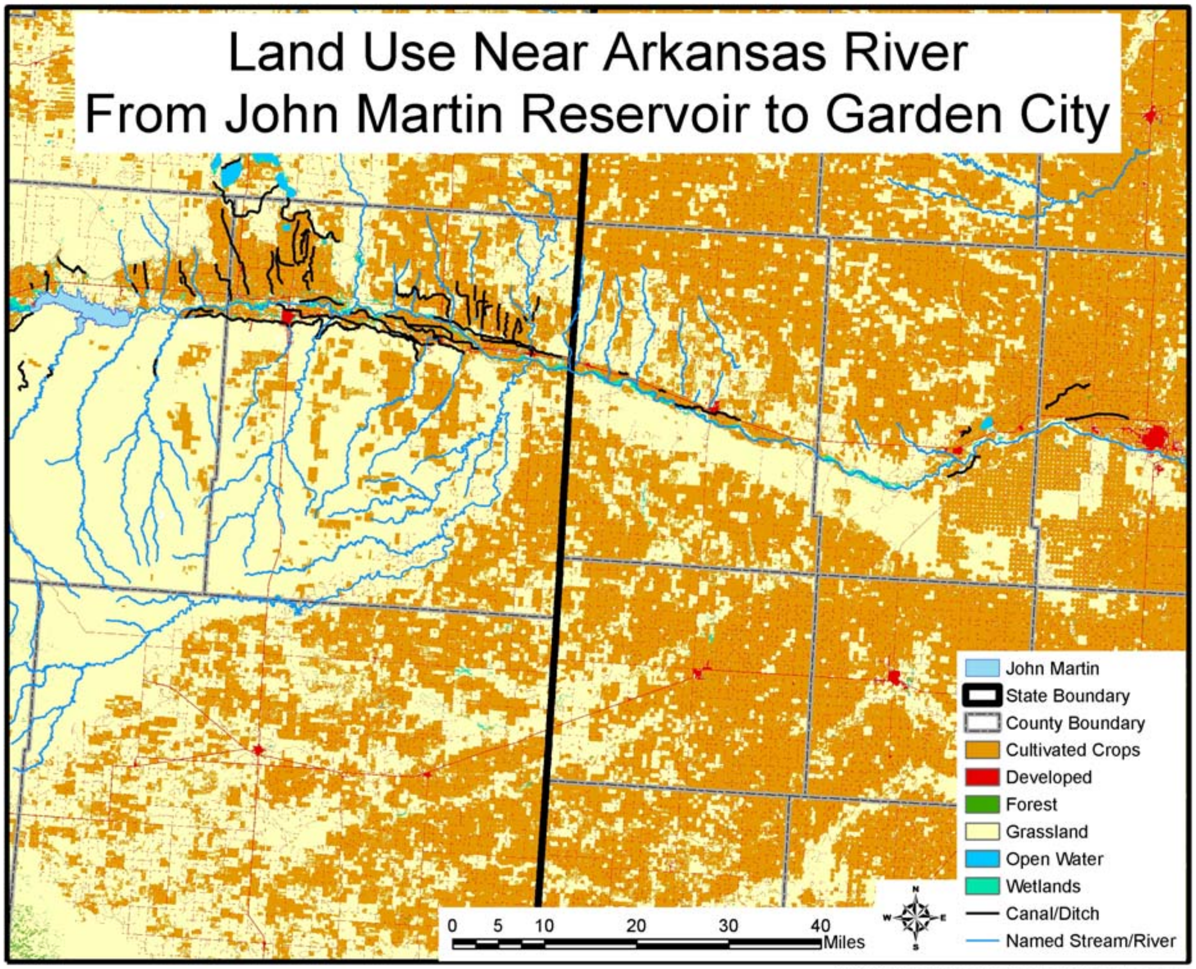
Sampling Site	County	Sampling Date	Flow cfs	Water T ^{o}C	Sp.Cond mS/cm	Salinity %	Sediment Se mg/kg dw	Water Se ug/l
Arkansas River near Lakin	Kearny	09/07/05	Est 0.1	17.8	3.87	0.19	0.27	4.6
Arkansas River near Lakin	Kearny	12/15/05	Est 0.1	-0.5	3.67	0.16	0.15	5.8
Arkansas River near Kendall	Hamilton	09/07/05	2.5	19.8	3.62	0.18	0.33	4.7
Arkansas River near Kendall	Hamilton	12/15/05	62	-0.5	3.62	0.16	0.16	5.2
Arkansas River near Kendall	Hamilton	05/19/06	11	25.0	4.33	0.22	0.54	2.9
Arkansas River near Kendall	Hamilton	09/11/06	78	20.6	3.52	0.17	0.46	4.5
Arkansas River near Coolidge	Hamilton	09/07/05	14	24.5	4.23	0.21	0.61	5.1
Arkansas River near Coolidge	Hamilton	12/15/05	70	-0.5	3.92	0.18	0.24	5.1
Arkansas River near Coolidge	Hamilton	05/19/06	8.5	13.8	5.00	0.25	0.63	4.4
Arkansas River near Coolidge	Hamilton	09/11/06	80	17.9	3.47	0.17	0.52	5.3
Arkansas River near Holly, Colorado	Prowers	05/19/06	13	16.8	4.95	0.25	0.48	4.1
Arkansas River near Holly, Colorado	Prowers	09/11/06	47	17.3	3.34	0.17	0.17	6.4

Appendix C. Non-Discharging or Non-Contributing Permitted Facilities Along Arkansas River in Hamilton, Kearny and Finney Counties

Municipal & Industrial NPDES						
Facility	**NPDES #**	**KS Permit #**	**Design Flow**	**WLA**	**Permit Expires**	**County**
Coolidge	**KSJ000273**	**M-UA08-NO01**	**0.0**	**0.0**	**12/31/07**	**HM**
Syracuse	**KSJ000258**	**M-UA39-NO01**	**0.0**	**0.0**	**12/31/07**	**HM**
Tarbet Ready Mix	**KSG110143**	**I-UA39-PR01**	**0.0**	**0.0**	**9/30/07**	**HM**
Deerfield	**KSJ000274**	**M-UA09-NO01**	**0.0**	**0.0**	**1/31/12**	**KE**
Finney Co. S.D.#2	**KSJ000209**	**M-UA14-NO03**	**0.0**	**0.0**	**1/31/12**	**FI**
Garden City Municipal Airport	**KSJ000279**	**M-UA14-NO01**	**0.0**	**0.0**	**11/30/07**	**FI**
Holcomb	**KSJ000263**	**M-UA18-NO02**	**0.0**	**0.0**	**6/30/07**	**FI**
Cheyenne Drilling	**KSJ000485**	**I-UA14-NP07**	**0.0**	**0.0**	**10/31/07**	**FI**
UBC-Concrete Industries	**KSG110059**	**I-UA14-PR01**	**0.0**	**0.0**	**9/30/07**	**FI**
Pappas Concrete	**KSG110113**	**I-UA18-PR01**	**0.0**	**0.0**	**9/30/07**	**FI**
Sunflower Electric-Holcomb	**KSJ000476**	**I-UA18-NP02**	**0.0**	**0.0**	**9/30/07**	**FI**
Tyson Meats-Holcomb	**KSJ000477**	**I-UA18-NP03**	**0.0**	**0.0**	**12/31/08**	**FI**

Agricultural Permits and Certificates (C) within half mile of Arkansas River							
Facility	**NPDES #**	**KS Permit #**	**Type**	**Animal Units**	**WLA**	**Permit Expires**	**County**
Coolidge Dairy	**KS0093343**	**A-UAHM-D001**	**Dairy**	**12,392**	**0.0**	**7/26/11**	**HM**
Premium Cattle	**KS0118419**	**A-UAHM-C004**	**Cattle**	**27,800**	**0.0**	**5/31/11**	**HM**
Syracuse Commission Co.	**NA**	**A-UAHM-B002**	**Beef**	**648**	**0.0**	**4/13/11**	**HM**
Cactus Feeders	**KS0052825**	**A-UAHM-C001**	**Cattle**	**66,000**	**0.0**	**11/7/10**	**HM**
Medway Replacement Heifers	**KS0005592**	**A-UAHM-C008**	**Cattle**	**10,500**	**0.0**	**5/21/11**	**HM**
B.Fuller	**NA**	**A-UAKE-BA07 (C)**	**Beef**	**30**	**0.0**	**8/29/10**	**KE**
Jones Pig Barn	**NA**	**A-UAKE-S001**	**Swine**	**144**	**0.0**	**11/21/10**	**KE**
Deerfield Feed Yard	**KS0037582**	**A-UAKE-C001**	**Cattle**	**45,000**	**0.0**	**7/19/11**	**KE**
Brookover Ranch	**KS0080918**	**A-UAFI-C016**	**Cattle**	**35,000**	**0.0**	**3/27/07**	**FI**
JO Cattle	**KS0037982**	**A-UAFI-C024**	**Cattle**	**2,000**	**0.0**	**6/25/11**	**FI**
JO Cattle	**NA**	**N-UAFI-4941 (C)**	**Beef**	**499.5**	**0.0**	**7/26/11**	**FI**

Appendix D. Summary of Irrigation Along Arkansas River in Colorado and Kansas



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Irrigated Acres in Upper Arkansas River Counties by Irrigation System Type

Irrig System	Hamilton Co	Kearny Co	Finney Co
Flood	2956 acres	7300 acres	24,188 acres
Center Pivot	2896 acres	7951 acres	19,079 acres
Center Pivot W/ Drop Down Nozzle	15,485 acres	66,210 acres	161,476 acres
Subsurface Drip	0 acres	131 acres	201 acres
Combined Flood & Center Pivot	6277 acres	12,879 acres	21,622 acres
Other Systems	32 acres	1678 acres	1946 acres

Source: 2005 Irrigation Use Report, Kansas Water Office (http://www.kwo.org/Reports%20%26%20Publications/2005_KS_Irrigation_Water_Use.pdf)

2005 Water Use in Upper Arkansas River Counties by Source and Type of Use

County & Water Source	Irrigation	Municipal	Industrial	Stockwater
Hamilton Co				
Surface	5828 af	0 af	0 af	0 af
Ground	29,079 af	771 af	45 af	1795 af
Kearny Co				
Surface	50,336 af	0 af	0 af	0 af
Ground	123,831 af	795 af	84 af	1142 af
Finney Co				
Surface	0 af	0 af	14 af	0 af
Ground	257,583 af	9363 af	7759 af	2538 af

Source: Division of Water Resources, Kansas Department of Agriculture Water Use Reports via WIMAS (http://hercules.kgs.ku.edu/geohydro/wimas/query_setup.cfm)

Irrigated Crops in Upper Arkansas River Counties

Crop	Hamilton Co	Kearny Co	Finney Co
Wheat	1900 acres	2119 acres	9013 acres
Alfalfa	3683 acres	30,553 acres	42,664 acres
Corn	2310 acres	23,249 acres	41,551 acres
Sorghum	1500 acres	630 acres	3850 acres
Soybeans	0 acres	1040 acres	8760 acres
Combination	18,245 acres	40,558 acres	122,680 acres

Source: 2005 Irrigation Use Report, Kansas Water Office (http://www.kwo.org/Reports%20%26%20Publications/2005_KS_Irrigation_Water_Use.pdf)

Distribution of Irrigated and Non-Irrigated Lands in Upper Arkansas River Counties

Crop	Hamilton Co	Kearny Co	Finney Co
Irrig Wheat	5600 acres	14,000 acres	55,600 acres
Non-Irr Wheat	142,000 acres	99,200 acres	120,400 acres
Irrig Corn	12,000 acres	43,000 acres	81,000 acres
Non-Irr Corn	3200 acres	6600 acres	4000 acres
Irrig Sorghum	5000 acres	3000 acres	12,000 acres
Non-Irr Sorghum	24,900 acres	29,900 acres	56,400 acres

Source: Quick Stats, National Agriculture Statistical Service, USDA (www.nass.usda.gov/QuickStats/)

Appendix E. Statement of Basis and Purpose for Classifications and Numeric Standards for Arkansas River Basin (Regulation #32) [5 CCR 1002-32] Pertaining to Kansas Salinity Issue; as adopted by Colorado Water Quality Control Commission on August 13, 2007

W. Proposal by the State of Kansas

The State of Kansas presented information that salinity and selenium concentrations increase between John Martin Reservoir and the state line (Lower Arkansas segment 1c), and that the concentrations of these constituents has increased over the last decade. Kansas participated in this rulemaking in order to expedite the identification of appropriate water quality endpoints for Lower Arkansas segment 1c, thereby facilitating development of TMDLs addressing these parameters. The Commission decided that, while adequate information is available to characterize irreversible selenium loading on several segments within the Arkansas basin, such is not yet the case in the lowermost portion of the basin. The Commission does, however, acknowledge the efforts undertaken by Kansas to address these pollutants in TMDLs promulgated earlier (sulfate), and planned for later this year (selenium) for the Arkansas River as it enters Kansas. The Commission expects the Division to work closely with the State of Kansas and stakeholders in addressing these issues upstream of the state line. The Division will work on UAAs to support attainable underlying standards, TMDLs where appropriate underlying standards have been adopted and implementation of remedial actions (BMPs) throughout the basin to reduce the loading of selenium.

Kansas asked the Commission to establish a Salinity Task Force that would lay the ground work for evaluating research results, selecting appropriate BMP’s and formulating a long-term strategy of salt load reduction to the river. At this time, the Commission cannot commit to such an expenditure of resources. However, the state is supporting a watershed restoration planning effort sponsored by Southeast Colorado Resource Conservation and Development with Clean Water Act Section 319 funding.

Later this fall Colorado will be in a better position to determine whether resources are available that could be allocated towards this issue. The Division will be completing a statewide prioritization of watershed restoration of impaired waters (as required by EPA) and will report the information to the Commission. This information may be used by the Commission to recommend revisions to the proposed priority watersheds.